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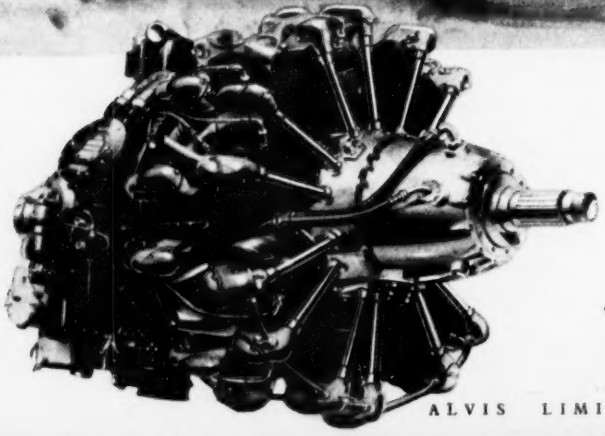

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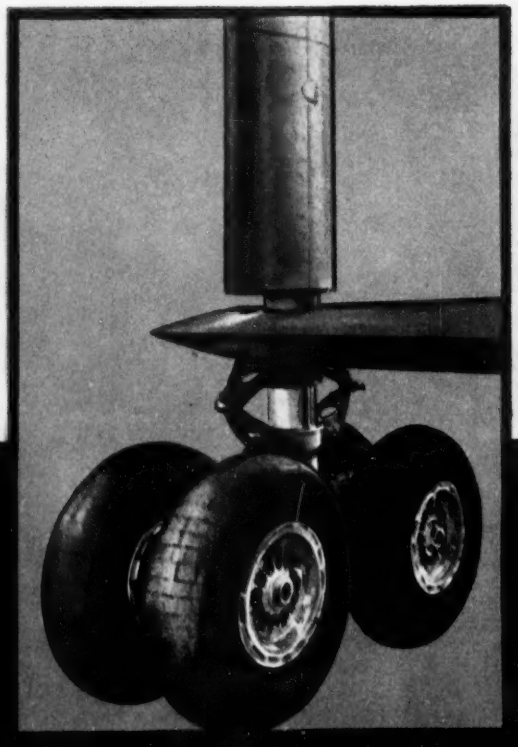

On the ground

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Nosewheel strut

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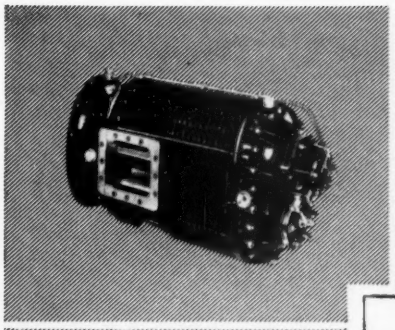
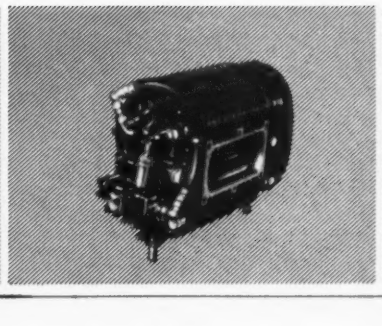
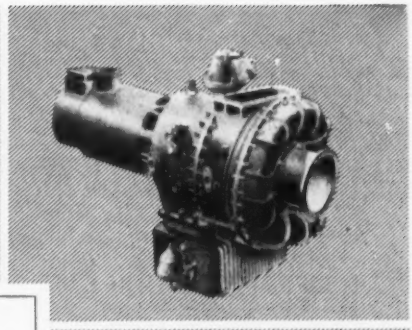
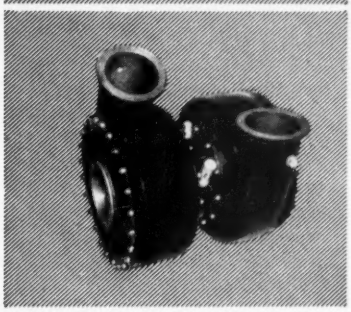
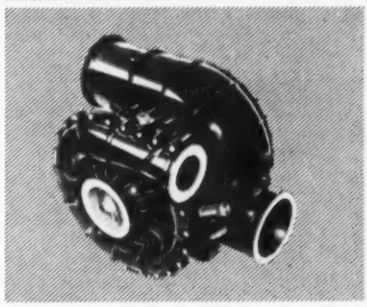
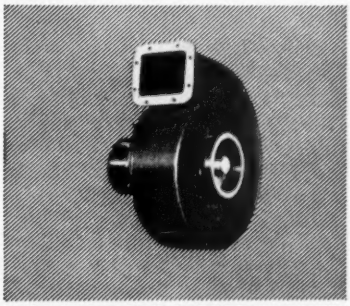
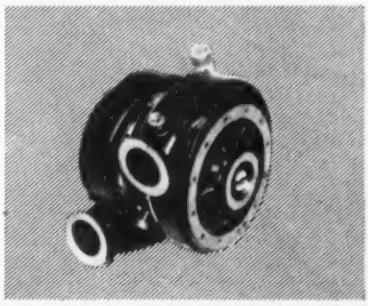
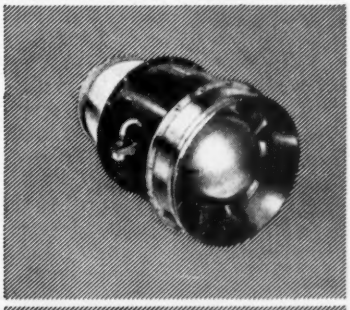
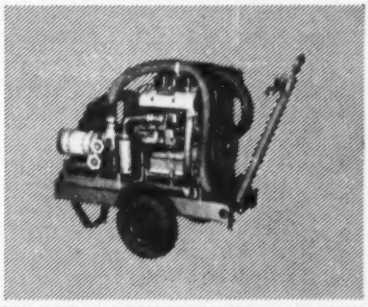
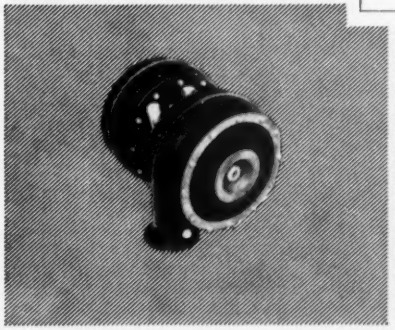
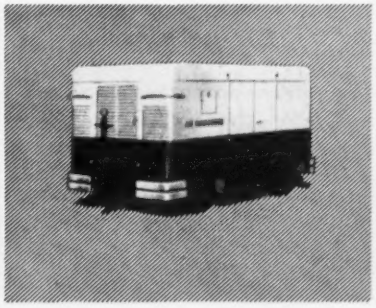
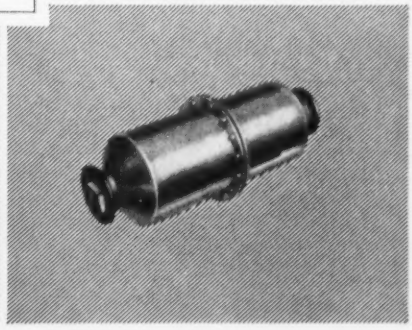

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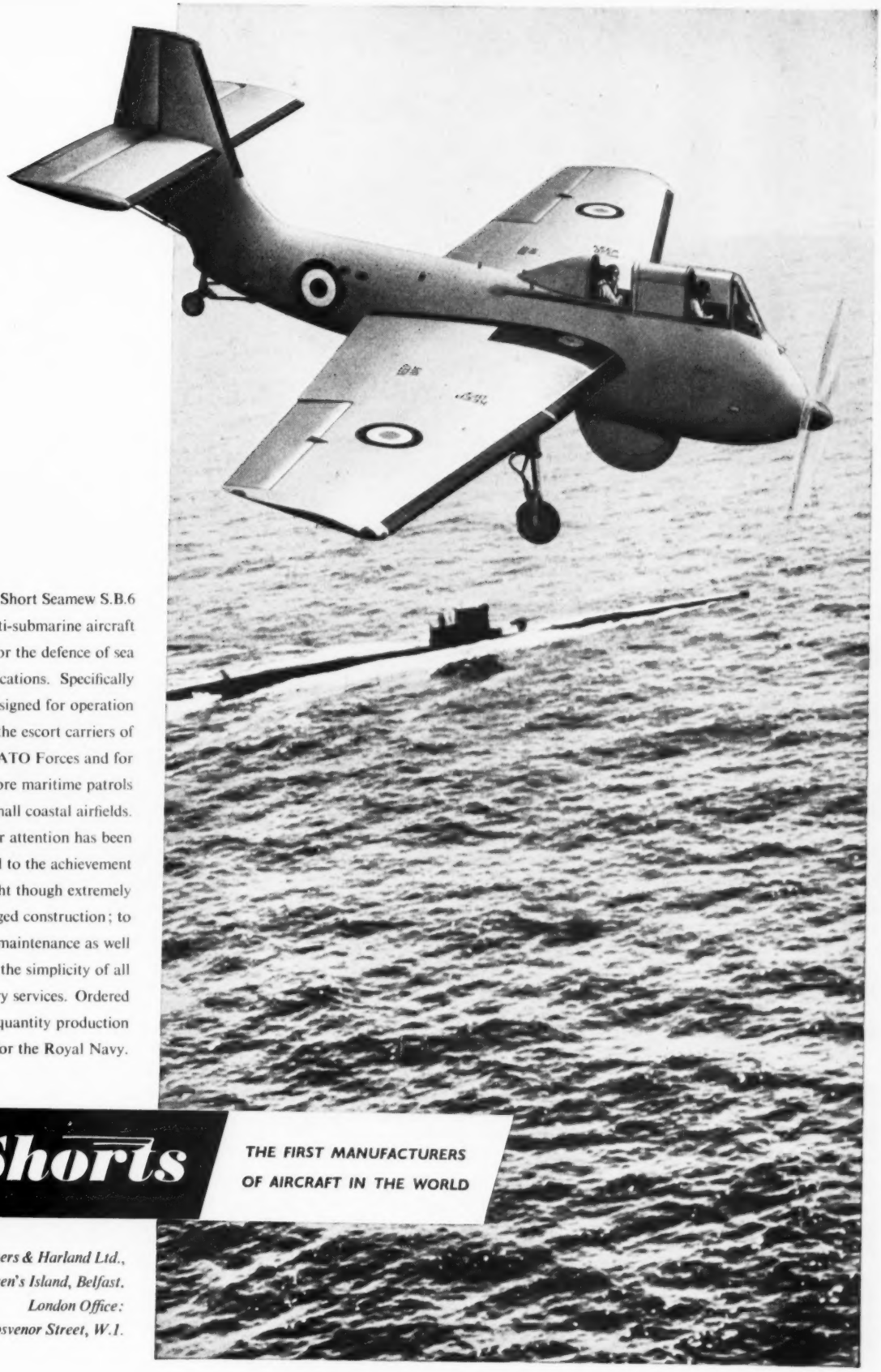

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P 35

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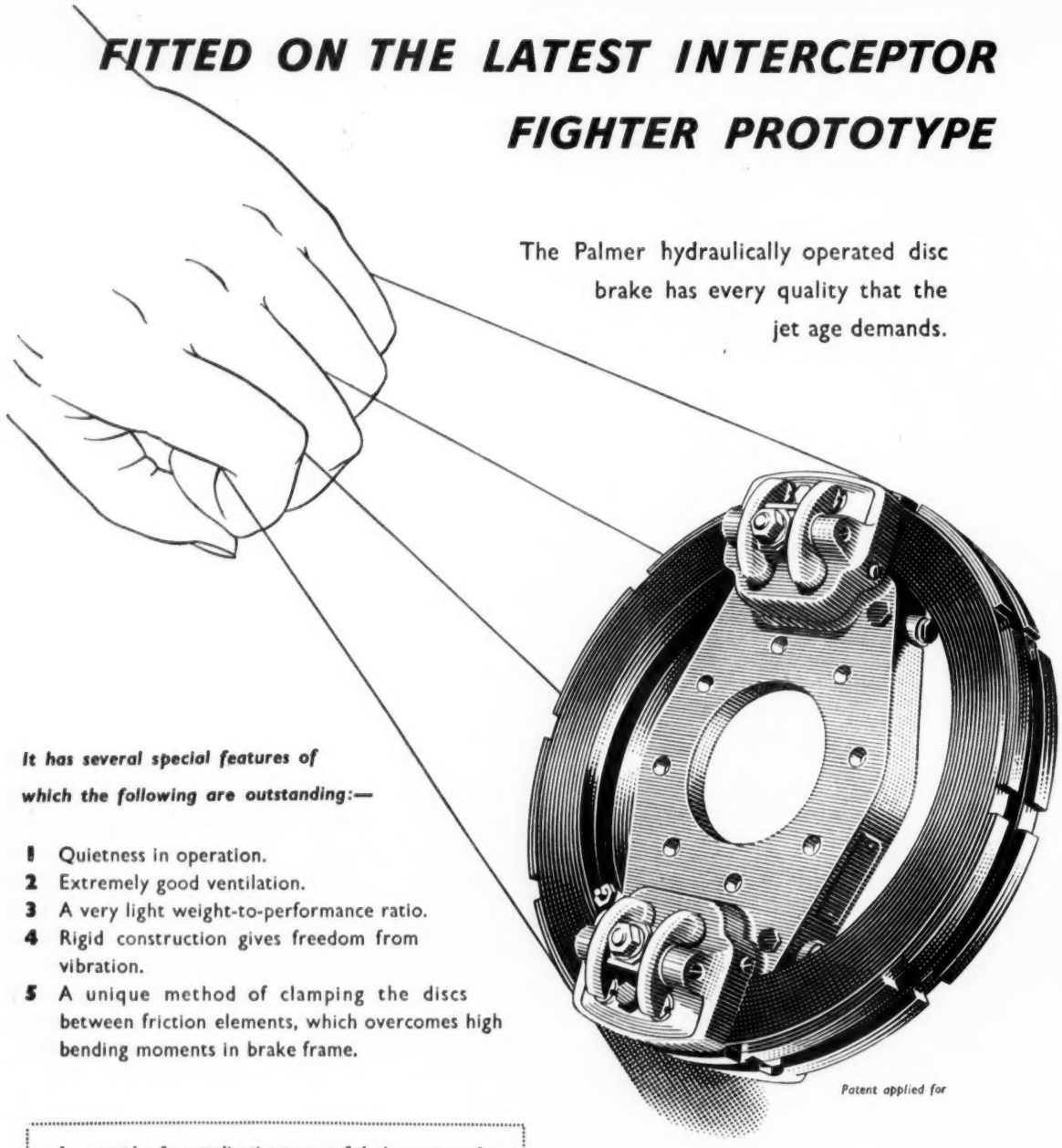

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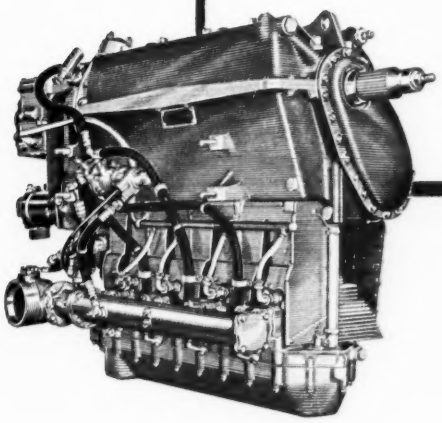

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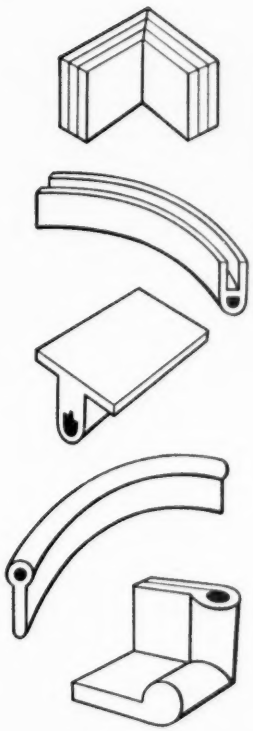

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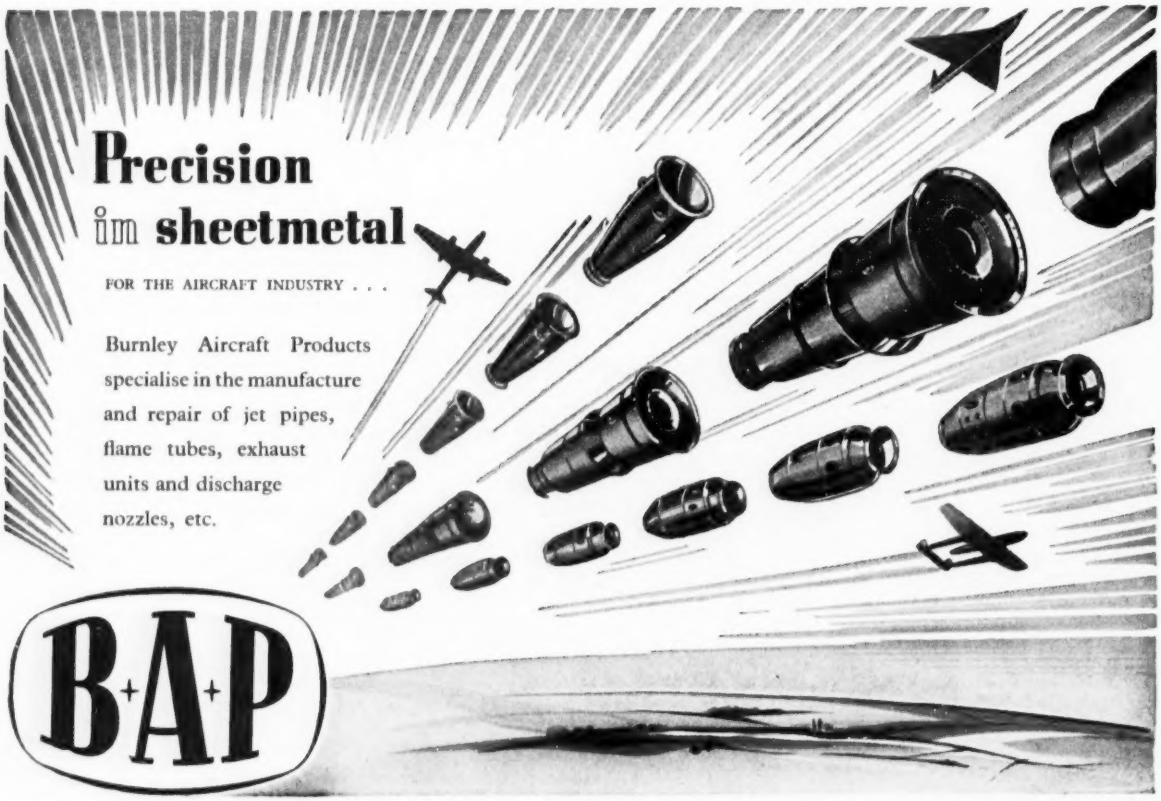
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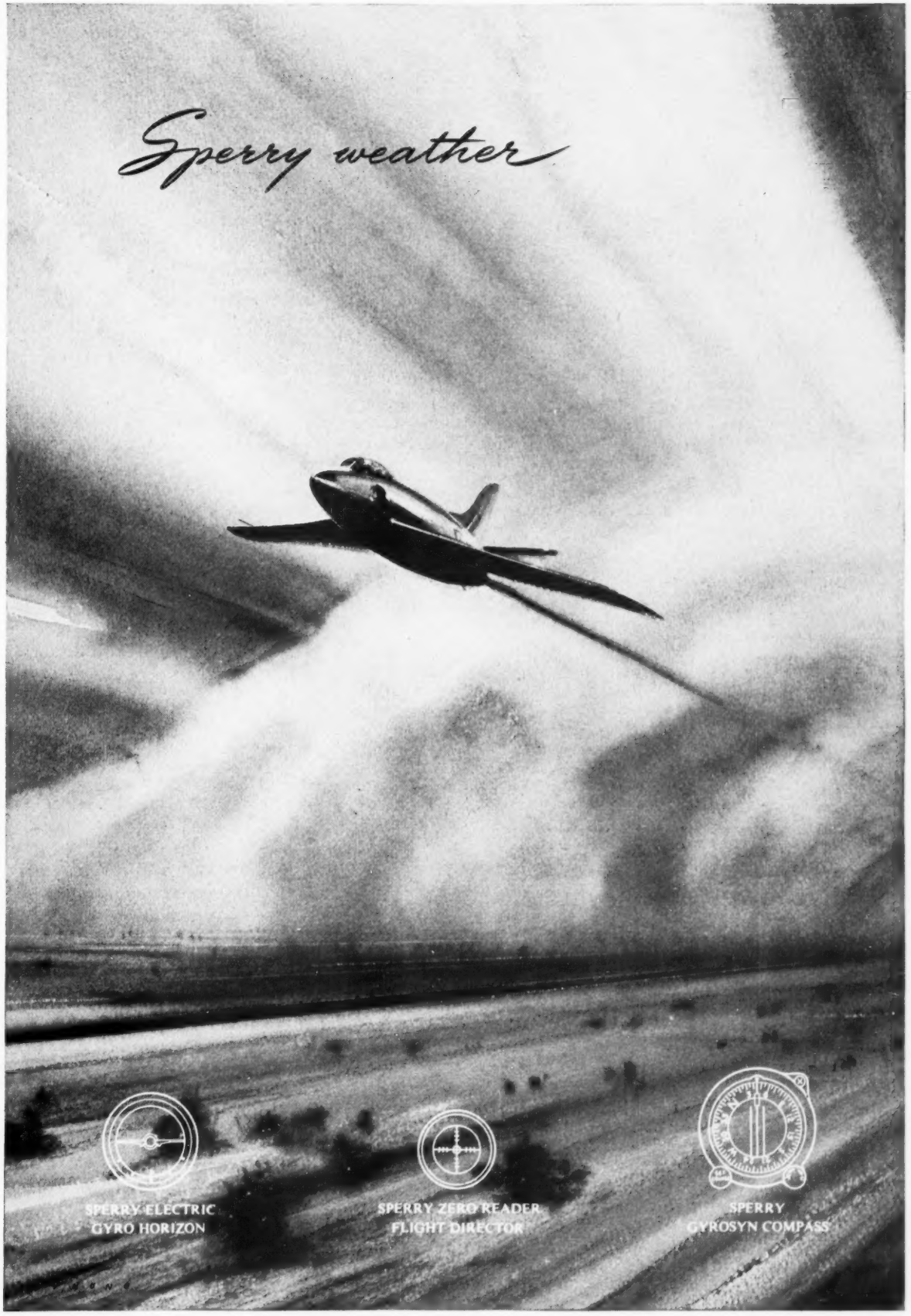
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B

THE FABLE OF MABEL THE MINOSAUR

It all happened several million years ago, in one of those intervals between the Great Ice Ages . .

Life in those days was nasty, brutish and short ; the law of the jungle prevailed, and progress—such as it was—meant merely a crude interpretation of the survival of the fittest.

The Mrs. Bruin's Academy of the period was inhabited not by Tiger Tim and Jacko, Jumbo and so on, but by creatures of hideous proportions and frightful savagery. There were foul, poisonous insects, evil-smelling plants, horrible sabre-toothed fishes as large as submarines, preposterous pterodactyls, dreadful dinosaurs and monstrous minosaurs.

And this fable is about a very remarkable minosaur whom we will call Denis. Denis was exceptionally intelligent (for minosaurs) ; he had read his Darwin and so knew what his species might expect from posterity. He was also peace-loving, crazy about games and fond of soggy cabbage.

"Look here, Mabel," he said to his wife one day, "it's time we began to think of the future. This is a tough life. We are threatened on all sides, and frankly I can't see much hope for the children." "We must adapt ourselves," said Mabel, "or perish. You know—natural selection and all that."

Denis pensively rubbed his scaly chin.

"You mean" he said at length, "that we must grow bigger and tougher, develop thicker hides, stronger claws."

"I *thought* you'd say that," said Mabel. "No, that's just what I *don't* mean. That's what all the others are doing—and look at them ! They are so big that they can scarcely drag themselves about ; their appetites are so enormous that the whole forest is threatened with famine. No, Denis, to survive we must be swift, compact, powerful and versatile. And we must multiply. It is the only way."

"But, surely," said Denis, "your proposals are contrary to the age-old principle that there is safety in bulk."

"True. I prefer to think that there is safety in speed and numbers."

Well, as we all know, the pterodactyls, the dinosaurs and so on died out. But what happened to Denis and Mabel and their minosaur offspring has never been discovered. Some authorities claim that they left the forests and colonized the planet Uranus ; others maintain that after millions of years of subtle adaptation to changing climatic, economic and military conditions they became lizards, or penguins or company directors.

We do not know, but the general concensus of opinion is that in some shape or form they did manage to survive.

In pursuance of their firmly held beliefs in matters of twentieth-century defence against air aggression, Folland Aircraft Limited, of Hamble, Hampshire, have undertaken an intensive programme of research, design and prototype development.

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and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

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C

Crew Cuts

THE path of technical progress has always been a rough one for the scientists, engineers or mathematicians concerned. In addition, many an "innocent bystander" has suffered in the cause of ultimate benefit to the majority. One example is that of new and ingenious machines which enable an industry to hold its own in a highly competitive international market and thus contribute to the national living standards, yet which, in the process, sometimes deprive individuals of their livelihood.

A position is now arising where certain commercial aircrew trades will be confronted with this kind of problem and, naturally enough, there is great concern among their ranks. We even know of certain farsighted R.A.F. pilots who have already said to themselves "In the foreseeable future technical progress will result in many, if not all, military aircraft being crewless; so I will make sure that I become well informed about missiles, radar and so on, in order that my services will continue to be in demand."

How are the airline fraternity reacting to their parallel problem? Commercial pilots are certainly not going to be eliminated for a very long time, but some of the other specialist aircrew categories probably will be. How are navigators or flight engineers to react to this threat to their livelihood? As was to be expected, the secretary of their professional organization, supported by some members, protested strongly at a recent meeting over the omission of navigators from aircrews the proceedings were summarized in *Flight* last week). In the view of this body, to dispense with the services of a professional navigator on long-distance airline routes would be to hazard the aircraft.

B.O.A.C., with the concurrence of the M.C.A., have stated that their policy in future is to crew entirely with pilots who will have, in addition, navigational qualifications—as do the majority at present. But so far the Corporation have not by any means dispensed with navigators and, in fact, have stated that implementation of their policy will, for the time being, mean simply that no new specialist navigators will be recruited.

Such legislation about the carriage of navigators as exists at present—and we understand that revisions are under consideration at the moment—is not intended to be comprehensive, but simply to indicate certain limits and requirements for stage-lengths and crews respectively. But how can one set of rules suit one 1,000-mile flight over Europe, another over the Indian Ocean and a third across South America? Even in the developed areas the provision of aids varies enormously. It may be added, too, that jet transports carry not only their passengers over the weather but also their instruments; so reception is usually greatly superior in quality and range to that enjoyed at lower levels.

Over one point we must deviate from the central path of impartiality and disagree with the Navigators' Union. We do not believe that B.O.A.C.'s crewing policy will be allowed to threaten safety standards. There did occur some time ago a grave navigational error in an aircraft over the Sahara. This isolated case concerned an aircraft which did not carry a specialist navigator. But reference (made at the above-mentioned meeting) to a Comet which in bad weather landed on a strip at Juhu, Bombay, instead of at the Santa Cruz Airport nearby, does not seem to us to be relevant to the navigator-or-not argument. Where the major scheduled airlines are concerned—and most others as well—considerations of safety can be left to the operator, who has a great deal at stake.

It may be observed here that B.E.A. carry no crew-member for navigation alone. On their stage-lengths up to 800 miles, either two pilots or a radio operator and two pilots comprise the crew; thus do adequate radio aids permit an economy with safety.

However, it is not our purpose here to become involved in the details, but to point out some of the factors and considerations. Turbine transports, which are the British commercial aircraft of the present and which will be the airline equipment for all in the near future, require precise planning before take-off and control of every minute of their flights. Instruments are being provided for automatic position-indication and distance measurement, and almost constant communication is maintained with the ground.

As a result of this kind of progress the routine work of the navigator as we knew it hitherto is being largely superseded by other methods and devices. In these circumstances, and having satisfied themselves regarding the safety factors involved on each route, airline operators cannot be expected to continue indefinitely to carry the cost and weight of a crew member solely for navigation, particularly when both the captain and the first officer must themselves be qualified navigators.

A new photograph of the prototype Viscount 700. This machine averaged 311 m.p.h. from London to New Zealand and for the purpose of the race was cleared for a take-off weight of 62,000 lb. In this instance the four Darts were picked examples of standard type, and did not include the improvements mentioned in the accompanying article.

VISCOUNTS' DARTS UP-RATED

Higher Performance and Lower Operating Costs for Series 700 Aircraft

LAST Monday evening, at a dinner at Weybridge given in honour of the crew of the British European Airways Viscount R.M.A. Endeavour, Mr. George Edwards, managing director of Vickers-Armstrongs' aircraft division, gave some most significant news concerning performance improvements for the Viscount. He announced that as a result of an increase in the power output of the Rolls-Royce Dart turboprops all 700 Series aircraft ordered from now on will be faster and more economical.

Speakers at the dinner—Mr. George Edwards for Vickers, Mr. Peter Masefield for B.E.A., Mr. A. G. Elliott for Rolls-Royce, and Captain Baillie of B.E.A.—paid their tributes to the aircraft, engines, ground organization and the aircrew in the New Zealand Race, to whom gold watches were presented. Mr. George Edwards received from Mr. Masefield a certificate of merit to the originator of the world's longest-range short-haul aircraft (the Cocos-Melbourne stage was 3,600 miles). Mr. George Edwards had mentioned earlier that Viscounts had now completed 11,500 flying hours and that five aircraft in service had each done about 1,000 hours. Some figures for the New Zealand round trip announced by Mr. Masefield included the following: 112 flying hours, 35 landings, 27 stages, overall average fuel consumption 292 gal/hr. Snags included one burst tyre, one damaged door seal, and electrical details. The big moments for the crew were the maximum-load take-off from Cocos (the machine was cleared for 62,000 lb a.u.w. and was certainly all of this) and the first sight of the Australian coast from 30,000ft with a ground speed of 405 kt. On the whole weather was good, but winds were not very favourable.

Internal modifications have made possible the up-rating of the Darts to give an increased cruising and climb power of 80-90 s.h.p. per unit. The changes include improvements to the guide vanes and turbine blades. Another development will later permit the take-off power to be raised from the present 1,400 s.h.p. (plus 375 lb) to 1,550 s.h.p., and this will in turn enable the Viscounts to take off at 60,000 lb a.u.w.—for which current production aircraft (take-off weight 58,000 lb) are already stressed.

Further good news is that all these improvements are capable of being incorporated in current aircraft, the appropriate time being at first scheduled engine change after the various modifications have been embodied in production engines. No indication has been given as to a new mark number for the up-rated Darts, and thus they will probably continue to be known as the R.Da3s.

Improved performance can make itself felt in several ways, and the first stage for the Viscounts will be a substantial increase in cruising speed, averaging 18 m.p.h. through the weights and altitudes. In addition the climb will be faster and the cruising altitude higher—with fuel consumption advantages. In fact, the

COMPARATIVE PERFORMANCE-DATA

Cruising Speeds:

	New	Old
15,000ft	331 m.p.h.	314 m.p.h.
20,000ft	329 m.p.h.	311 m.p.h.
25,000ft	323 m.p.h.	304 m.p.h.

Range/Payload:

The ranges shown are with fuel allowances for take-off, circuits, landing and taxying and the following reserves: (a) Fuel for 45 min holding at 5,000ft. (b) Fuel for 230-mile diversion.

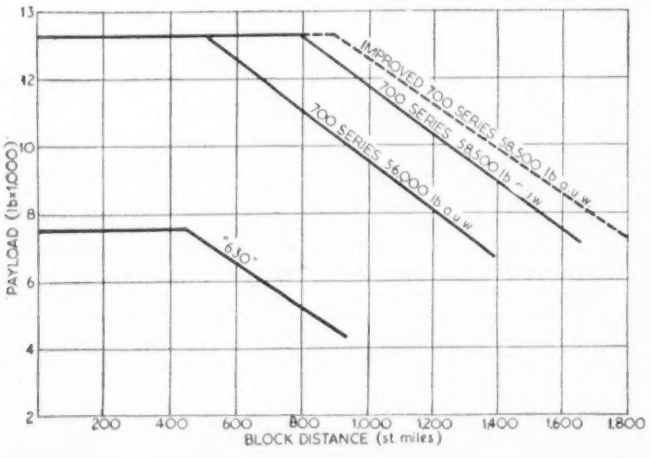
	st. miles	st. miles
Max. capacity payload range (13,320 lb)	900	800
Range (8,000 lb payload)	1,670	1,530

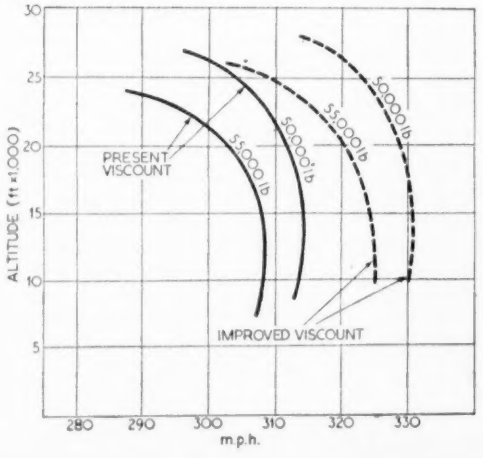
Block Speed:

With all the usual allowances, the comparative block speeds and times (doors shut to doors open) for the various distances are:—

Stage miles	New m.p.h.	New hr min	Old m.p.h.	Old hr min
345	236	1 21	231	1 27
575	262	2 9	255	2 15
920	277	3 19	269	3 26
1,150	284	4 0	274	4 10

(Left) Curves indicating the improvement in specific fuel consumption between the current Dart R.Da3 and the up-rated version. (Right) Cruising speed for the Viscount 700 with present power and with up-rated turboprops at representative operating weights.





specific consumption of the Darts is reduced by some 9 per cent, and the effect is to provide all the performance increases for no more than the earlier (lower power) fuel consumption. Range, payload or both can benefit accordingly, and, of course, costs per ton-mile or per passenger mile will be decreased. The pence-per-ton-mile figure for ranges up to 800 miles shows about 4 per cent reduction; after 800 miles it builds up rapidly to a 10 per cent reduction, and at extreme ranges of 1,600-1,800 miles, 15 per cent reduction.

In performance, quite apart from its qualities of safety and passenger appeal, the Viscount already has the edge on any of its competitors; and these major improvements—all of which, state the makers, will be available to operators who place orders henceforth—give the aircraft a clear lead.

The various stages in the development of the Viscount from the prototype 630 up to the latest Series 700 with 60,000 lb a.u.w. are summarized in the "official history" below :—

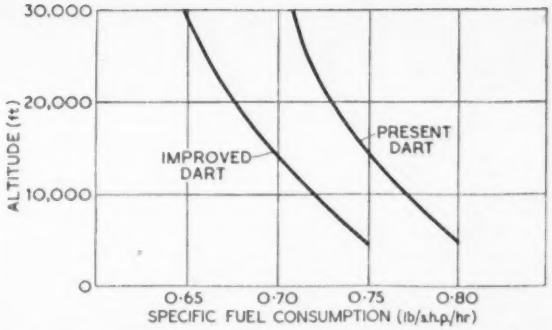
38,650 lb.—The first Viscount—the "630" G-AHRF—flew on July 16th, 1948. It was a 32-36-seater and had a take-off weight of 38,650 lb and a payload of 7,500 lb. The engines were four Rolls-Royce Dart R.Da 3/2 (520's), which were each initially of 1,000 s.h.p. and were intended to cruise at 625 s.h.p. at 13,300 r.p.m. Later 13,400 r.p.m. was permitted and the s.h.p. ranged from 790 at 2,000ft to 570 at 18,000ft. The "630" cruised at 275 m.p.h.

This prototype aircraft received a full C. of A. and B.E.A. put it into passenger-carrying operation on the London-Paris and London-Edinburgh routes in the summer of 1950. These were the first operational services by any kind of turbine airliner and over 1,800 passengers were carried in 26 days.

During 1947 it had become known that the Dart was being developed to 1,400 s.h.p. in the R.Da3 and, to make best use of this improved output, the Viscount 700 series was designed.

48,000 lb.—The prototype "700" first flew in August 1950, as a 40-48-seater with a take-off weight of 48,000 lb and a cruising speed of 310 m.p.h. at 25,000ft. It was this aircraft (G-AMAV) which, at an all-up weight of 62,000 lb, flew in the recent New Zealand Race at 14,000 lb over its original take-off weight.

The Viscount 700 was 6ft 8in longer in the fuselage than the "630," and had a 5ft greater wing-span.



Payload versus block distance with allowances and reserves for a diversion of 230 statute miles and 45 minutes' stacking at 5,000ft.

G-AMAV has now flown over 1,250 hr and been used for arctic and tropical trials. For the winterization tests it was flown to Canada in December 1952, and thus made the first North Atlantic crossings by a turbine-powered airliner.

56,000-58,500 lb.—The first production Viscount 701 (G-ALWE) flew in August 1952 and had a full C. of A. at 56,000 lb. This was 6,000 lb over the B.E.A. contract figure but with the empty weight remaining within the original guarantee. The first B.E.A. aircraft have been delivered to this 56,000 lb figure, but the eleventh and subsequent "701s" are now being delivered at 58,500 lb and are stressed to 60,000 lb. The first 58,500 lb Viscount was G-AMNZ, appropriately named—in view of its registration—*James Cook*.

60,000 lb.—As a direct result of further improvement in the Dart R.Da3 engine, a new chapter now opens. Cruising power at 18,000-25,000ft has been increased by 80-90 s.h.p. per engine and, at the same time, specific fuel consumption has been reduced. The net gain is that Viscounts with these new engines will be 10-15 kt faster, while specific fuel consumption is reduced by 9 per cent. An up-rating of take-off power from 1,400 to 1,550 s.h.p. will follow, allowing the all-up weight to reach 60,000 lb.

FROM ALL QUARTERS

The Duke at Filton

IN view of his first-hand and steadily increasing knowledge of aeronautical matters, visits to aircraft factories must be among the more enjoyable duties which H.R.H. the Duke of Edinburgh has to perform. That this is in fact the case was very apparent from the keen interest which he showed in everything he saw during a two-hour visit to the Bristol Aeroplane Company at Filton on Friday last. The works tour, incidentally, was in the nature of a diversion, for the primary purpose of the Duke's journey—which he had made in the Royal train from Scotland—was an official visit to the City of Bristol, during the course of which he was made an honorary freeman of the Society of Merchant Venturers.

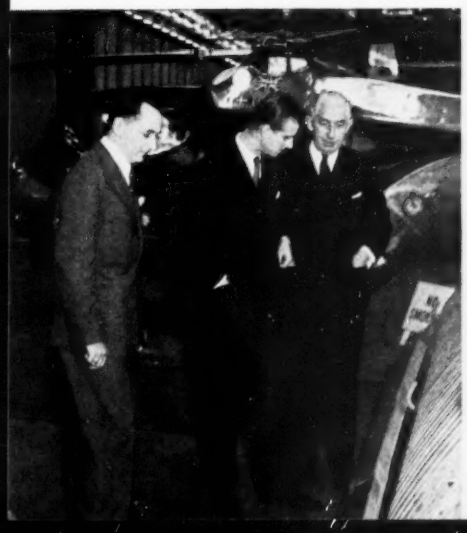
His Royal Highness, accompanied by the Duke of Beaufort, arrived at the works shortly before 10.30 a.m. and, after the directors had been presented to him, moved across to the Brabazon assembly hall, where he spent a considerable time in the interior of prototype Britannia—mostly in the cockpit, where, in the subsequent words of chief test pilot A. J. Pegg, "he asked the sort of questions only a pilot could ask." The Duke was next shown the Olympus-Canberra, with assistant chief test pilot Walter Gibb (who took it to the record height of 63,668ft last May) in attendance. He also visited the Olympus test-house, where he tried for himself the rapid acceleration of an Olympus on test.

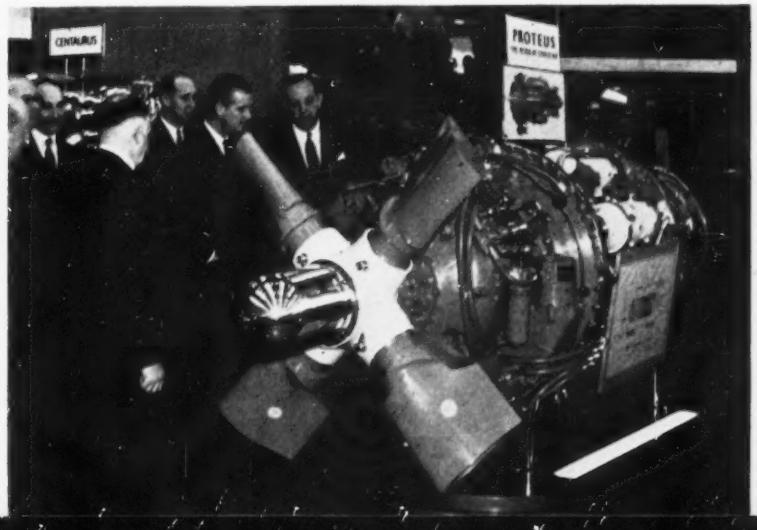
The Royal visitor examined other engines and Bristol cars, and for a time disappeared into one of the "secret" sections of the works where missile development is conducted; here, to judge by the noise, he saw a ramjet fired. To complete his inspection—which he probably found all too short—of B.A.C.'s widely assorted activities, he saw helicopters under assembly and examined a Freighter nearing completion to fulfil an export order.

A SIGNAL OCCASION

December 17th next is the 50th anniversary of the first powered flight by a heavier-than-air machine—the Wright brothers' biplane. Preparations are being made by learned societies and other organizations to commemorate the anniversary in a fitting manner; and FLIGHT is to make its own contribution by the publication of a special number—on Friday, December 11th. Greatly enlarged and specially illustrated, this issue will tell the story of the principal aeronautical developments of this momentous half-century.

ROYAL VISIT TO FILTON: (Left) Assembly of helicopter rotor blades is explained to the Duke of Edinburgh by Mr. C. F. Uwins, managing director, aircraft division; Mr. Raoul Hafner, chief helicopter designer, is at left. (Right) The Duke is interested in a Proteus; showing it to him is Dr. S. G. Hooker, chief engineer, engine division. Behind His Royal Highness is Mr. G. W. Wright, general manager, engine division.





FROM ALL QUARTERS . . .

New Principal Director of Engine R. & D.

WHEN, at the end of the year, A. Cdre. F. R. Banks vacates the post of Principal Director of Engine Research and Development, Ministry of Supply, in order to return to the Associated Ethyl Co. (from whom he is "on loan" to the Government) he is to be succeeded by the present Director, Mr. R. H. Weir, B.Sc., F.R.Ae.S. The appointment was announced by the Ministry last week.

Educated at Allan Glen's School, Glasgow, and at Glasgow University, Robert Hendry Weir (who is now 41 years of age) began his engineering career in 1928 as an apprentice at the famous Dumbarton marine engineering firm of William Denny and Sons, Ltd. Finding that his inclinations lay in the direction of aeronautical engineering, he secured a post as a technical assistant at the R.A.E., Farnborough, in 1933, and thereafter received steady promotion. At the beginning of the war he was a senior technical officer at the A. and A.E.E., Boscombe Down; from 1942 to 1944 he was with M.A.P. in a similar capacity, thereafter becoming a principal technical officer in that Ministry and its successor, the Ministry of Supply. From 1947 to 1949 he was an M.o.S. principal scientific officer, and was then made an assistant director. For two years before assuming his present post, he was the Ministry's Director of Industrial Gas Turbines.

In Ten Years' Time

AIR COMMODORE BANKS was also in last week's news from Canada, where he has been attending the convention of the Air Industries and Transport Association. Answering questions from journalists on the subject of jet airliners, he said Britain would be able to "hold her own" against American competition in the jet field. The Americans, however, built very good aircraft and in from five to ten years this country would have stiffer competition to face.

He added that improvements in the efficiency of turbojet- and turboprop-powered aircraft could be made, but there were no radically new types of aircraft engines "on the horizon."

Fuel consumption had generally been cut by 20 per cent since the early jet engines went into service, and he predicted that another 20 per cent cut would be made in the next ten years.

Asked about the noise problem, A. Cdre. Banks said: "We now think we can cut the noise of jets, in the low-frequency band, to an acceptable level."

Things to Come

THE Fifth of November was chosen by the Graduates' and Students' Section of the Royal Aeronautical Society for a talk on rockets and where, some time in the future, they would take us. The speaker was Mr. Arthur C. Clarke, B.Sc., F.R.A.S. (chairman of the British Interplanetary Society), the talk was entitled "The Exploration of Space," and the chairman for the evening was Mr. A. V. Cleaver, A.F.R.Ae.S., of the de Havilland Engine company. The library of the Society was overcrowded some time before the meeting began.

Mr. Clarke's talk was based on a series of slides, many in colour, illustrating present work on rockets and probable future developments in interplanetary travel. He began by describing the use of telescopes for astronomical observation, and pointed out that soon man would obtain knowledge by actually travelling to the planets. This was made possible by the development of rocket propulsion, Mr. Clarke continued (as rising orange streaks seen through the window behind the speaker indicated a small-scale yet popular application of the same principle).

After describing work at the rocket proving ground at White Sands, New Mexico, and the multi-stage principle for obtaining increased velocity in rocket missiles, the speaker explained the "fundamental idea of orbiting the earth" some 1,000 miles from it. This could act as a stepping stone on which to refuel before continuing on to outer space. Mr. Clarke's subsequent mention of 25,000 m.p.h. (as the velocity needed to escape from the earth's gravity) was received with suprising yet commendable calm by his audience.

There would be three distinct types of vehicles, he continued: relatively short-range tankers, machines capable of reaching and landing on the moon, and "deep space vehicles, unstreamlined, travelling from orbit to orbit and not landing." Useful concept of the science-fiction writer, "nothing has any weight in this orbiting," was confirmed by Mr. Clarke—but, in connection with what the well-dressed space explorer would wear, he emphasized, "strictly none of the goldfish-bowl stuff."

The remainder of the speaker's talk was a fascinating account —illustrated by some breath-takingly beautiful colour pictures—of some of the novel phenomena and problems which would probably come with the advent of space exploration. When would this be? Exploration of the moon, by the end of this century—or in 20 or 30 years, given money.

And finally, why explore space anyway? There were many reasons, including both the scientific search for knowledge and a sense of adventure.

A vigorous discussion followed, with questions ranging from the esoteric problems of relativistic mechanics to the simple, inevitable, "what about flying saucers?" Concerning the latter, Mr. Clarke summarized with finality: "Flying saucers have *not* landed, and there are *no* little men."

A Shock at Southampton

ONE morning last week, when we were paying a visit to Eastleigh (Southampton) Airport, we noticed that the blue Supermarine S.6.B Schneider seaplane, still marked No. 7, and the actual aircraft in which F/L. G. H. Stainforth took the world's speed record in September 1931, at 379.05 m.p.h., was sitting in the corner of a hangar. We recalled that some time ago this aircraft had been presented to the Southampton Municipal authorities so that they might arrange for its preservation and exhibition at some appropriate place. The same afternoon, to our horror, we saw workmen approach this classic and most beautiful aircraft and start to take it to pieces in order, according to bystanders, to "hang it on the wall" or "throw it out" because the hangar space was required.

Surely this is one machine which must at all costs be saved from the breakers or elements? By virtue of the material of its construction it has so far remained well preserved from corrosion and damage. We have since learned that there is a possibility that the original makers may, at this eleventh hour, take a hand in assuring the S.6.B's future. We hope this will be so.

Following the views expressed by A. Cdre. A. H. Wheeler in his article "A National Museum of Aircraft?" in *Flight* last week, we are glad to see signs that at least one firm of manufacturers is taking an interest in the fate of its veteran products. Apart from the S.6 move mentioned above, Vickers are said to be anxious to preserve the original Wellington—a Mk. 10, serial MF628—if the Air Ministry can be persuaded to part with it; and they also hope, we believe, to preserve two early marks of Spitfire, one in flying trim and the other as a "museum-piece."

Stability and Control

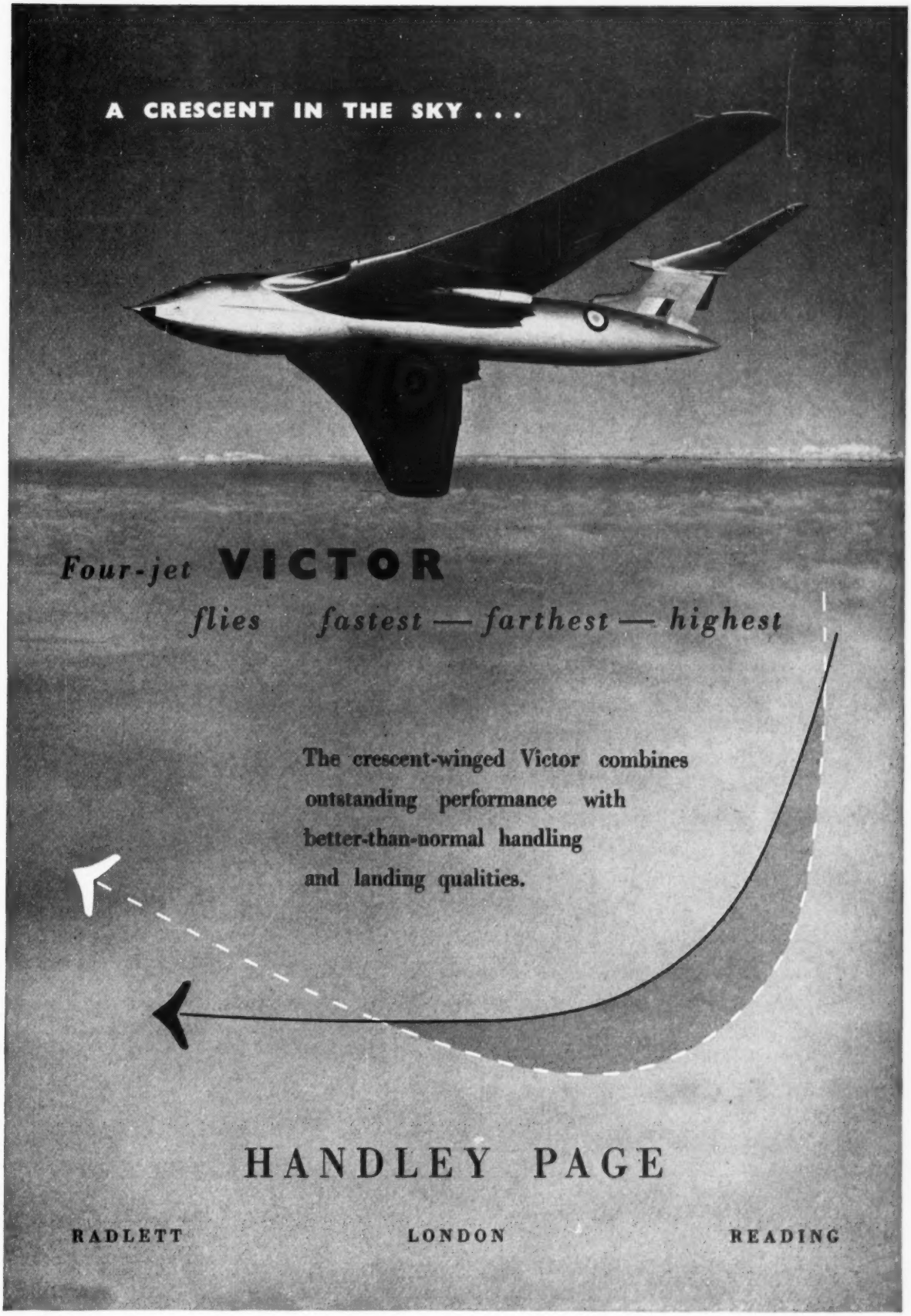
AT the Institution of Mechanical Engineers last night, November 12th, Mr. J. C. Wimpenny, A.F.R.Ae.S., was due to give a lecture, "Stability and Control in Aircraft Design," before members of the Royal Aeronautical Society. In the first part of his paper, the author defined stability and control requirements as related to the pilot's judgment of an aircraft's handling qualities, and discussed a number of current problems concerned with control feel and dynamic stability. To gain more insight into the make-up of good handling qualities, he stated, more measurements of the stability and control behaviour under dynamic conditions were required, together with more effective methods of analysis.

Mr. Wimpenny's paper went on to describe the determination of air forces, and the correlation between theory and test for the more important derivatives. Concerning the design of an aircraft, either the explicit or the overall method of examination could be used. Tail design and wing design respectively were then considered in detail by the author, who, after discussing power controls and repeatability, concluded by summarizing the outstanding problems of stability and control which the designer faced today.

We hope to print a fuller summary of Mr. Wimpenny's paper in an early issue.

Helicopters and the Independents

IN a discussion held in the library of the Royal Aeronautical Society on November 6th, members of the Helicopter Association heard contrasting points of view on "The Independent Airline Operator and the Helicopter." The chairman was Mr. D. L. Hollis-Williams, of Westlands, and the first main speaker was Mr. I. J. Rees, B.Sc., A.F.R.Ae.S., who described some of the overseas operations performed by his company, Airwork, Ltd., and for which the helicopter might be suitable. Capt. B. Greensted, M.B.E., of Hunting Air Transport, then presented his paper, "Independent Ideas on Helicopters" and the final paper was "Development of an Aerial Spraying Contract Service," an account of the helicopter activities of Pest Control, Ltd., by Mr. J. E. Harper, A.F.C. In the brief discussion which followed, it transpired that Capt. Greensted's paper had provided controversy; we hope to give a full account of the meeting in next week's issue.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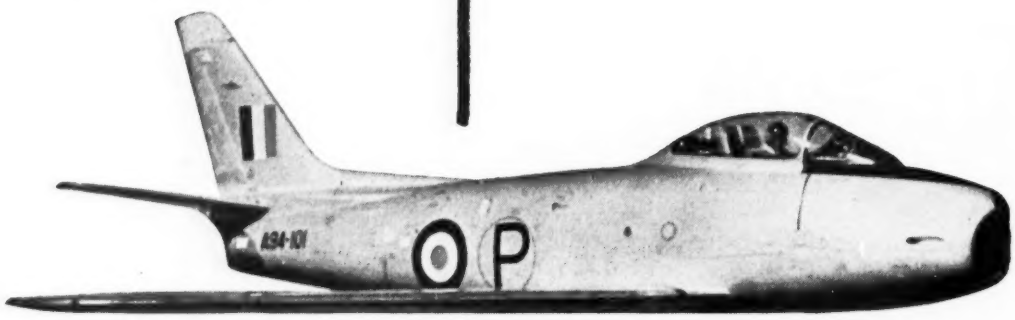

Australia

The Air Board of the Royal Australian Air Force have evaluated the Redifon Flight Simulator technique and placed a contract for a number of Avon Sabre Flight Simulators.

NOTE. *This advanced training device enables experienced pilots to improve their proficiency by practising all normal and abnormal manoeuvres under instrument flight conditions. In addition the engine handling and emergency procedure can be rehearsed and practised again and again while in safe and friendly contact with the ground.*

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PLANS FOR THE PRINCESSES

EVENTS of the past few days have brought encouragement for all those who feared that the magnificent Saunders-Roe Princess flying-boats might suffer the same fate as the Brabazon. It would be premature to forecast where or when the Princesses will enter service, who will operate them, or when suitable engines will be available. However, now that both B.O.A.C. and Aquila Airways have announced a desire to acquire and operate them, there is some guarantee of a commercial future for these splendid craft.

According to a report published last Friday, Sir Winston Churchill has given instructions that an operational future must be found for the three Princesses. Such action would certainly be characteristic. The same day B.O.A.C. issued the following statement:—

"Clearly, in view of economic considerations, B.O.A.C. has had to move cautiously during the past few years. We had to be assured that a suitable flying-boat engine was available before we were in a position to take a view. Now, however, a Proteus major turboprop engine is being developed by the Bristol Aeroplane Company—a British jet power-unit that should give the Princess flying-boats the long range and passenger-carrying capacity required to make them very competitive on international air routes.

"Sir Miles Thomas, chairman of B.O.A.C., has always held the view that flying-boats are a peculiarly British sphere, combining the British maritime tradition with Britain's most up-to-date achievement—the development of the jet engine.

"Accordingly, B.O.A.C., with its long experience of flying-boat operations, will co-operate with the Government and the Saunders-Roe Company in the operational development of the Princess.

"It is yet too early to say where the Princess might be flown commercially—the matter is under close study—but it should be possible to operate it world-wide on most of the B.O.A.C.'s present Commonwealth and Atlantic routes."

It was also learned that Capt. H. W. C. Alger, the former manager of B.O.A.C.'s No. 4 (flying-boat) Line at Hythe who was seconded to Saunders-Roe in August 1951, is now in North America making enquiries about possible flying-boat bases. Capt. Alger was selected in 1950 to be manager of the Princess Unit then being formed to prepare for operating the new flying-boats on B.O.A.C.'s routes. The unit was disbanded shortly afterwards.

On Saturday, November 7th, the day following B.O.A.C.'s statement, Mr. Eoin C. Mekie, chairman of Aquila Airways, Ltd., disclosed that his company had offered to pay "much more than £1m for each aircraft." He said:—

"In view of the prominence given to B.O.A.C.'s comments on the future of the Princess flying-boats, I wish to make it quite clear that Aquila Airways made a firm offer to the Ministry of Supply on Thursday, November 5th, 1953, to buy all three machines. This offer was made in response to an approach by the Ministry to all independent airlines and I believe it is the first and only offer."

Aquila Airways, Ltd., are at present Britain's only civil flying-boat operator, with a fleet of two Solents and four Hythes. Last March the entire share capital of Aquila was taken over by Britavia, Ltd., parent company of Silver City Airways, Ltd. Aquila's plans for the Princesses have not been revealed, although Mr. Mekie has expressed confidence that they could be operated at a profit.

The first Princess, now being test-flown, made her maiden flight in August 1952. The other two airframes have since been completed and cocooned, and are in storage at Calshot. Estimated cost of the three aircraft up to June 1952 was stated last year to be £10,800,000.

The ten Proteus 2s—eight of which are in coupled units—now fitted in the first Princess are a temporary installation only. For operational use, military or civil, more powerful turboprops will be necessary. It is now generally accepted that fewer engines—*e.g.*, six Proteus 3s—would be preferable to the present ten units, with their attendant weight and complexity of coupling gear. The fact that coupled engines would be peculiar to these three flying boats would add to maintenance difficulties, whereas the single units are intended for large-scale airline service.

With Government approval it might be possible to obtain 3,780 e.h.p. Proteus 3s—now in super-priority production for the Britannia—for installation in the Princess. Even so, the big flying-boats are not likely to be ready for service for at least three years, and the installation of six of any existing type of Proteus would reduce the effective range to 1,500-2,000 miles. Alternatively, according to Sir Miles Thomas, the Princess might be fitted with "major Proteus engines," which would give it a commercial performance, but these would not be ready for four or five years.

No further details of such an engine, presumably one intended for later Britannias or their derivatives, are available. However, the following carefully phrased statement was issued on Monday by the Bristol Aeroplane Co.:—

"When work on the Princess project was suspended on Government instructions, development of the Coupled Proteus engines specified for the boats was also suspended. Since then, Bristol development of turboprop engines in single form has been so encouraging as to make it possible to offer the required power for the Princess with the use of single engines only, thus obviating the need for the elaborate coupling gear. This proposal is under examination by the interested parties."

"Flight" photograph

The latest—but certainly not the last—words on the subject were, at the time of going to press, contained in a message to B.O.A.C. staff issued by Sir Miles Thomas on Tuesday afternoon. Some extracts are quoted below.

"So many confusing statements have been published by the Press in connection with the future of the Princess flying-boats, and there is so much interest in flying-boats among B.O.A.C. personnel, that I feel that the Corporation's position in the matter should be made clear." [In parentheses, we would observe that "confused" Press reports often result from failure to provide the Press with clear and accurate information.]

". . . With its original engines, the Princess flying-boat was, in our assessment, uneconomic. Therefore we said that we would not operate them commercially on our scheduled services. But we always realized that engines might be developed that would give the boats an economic performance. . . .

"Moreover, in September 1952 we offered to set up a marine development flight as part of the Corporation's organization, but separate and distinct from our normal commercial operations. . . . We were told, however, that it was doubtful whether operations on the scale we had contemplated would materialize for a few years, and it was suggested that the matter should be deferred. . . .

"As soon as the Bristol Aeroplane Company, in collaboration with Saunders-Roe, had reached a stage in the development work on a type of engine which gave promise that the Princess would be an economic proposition, the Corporation showed renewed interest in the boat. . . .

"We had conversation with officials of the Ministry of Supply on October 20th, and on October 28th I had a formal meeting with the Minister of Transport and Civil Aviation in the House of Commons, the record of which concerns our proposals to operate the Princess. . . .

"Our broad proposals are that when the hull has been fitted with engines that will give them a competitive commercial performance we will buy them at the commercial price then current, and operate them on world-wide routes. It is unlikely that the appropriate engines will be developed before 1958.

"In the intervening period, suitable preparations for operating the boats on passenger and freight routes will be developed. It will be appreciated that the Corporation is in a unique position to make the best showing of these aircraft, in which so much public money has been invested."

ON SAFARI

Two colourful and cheerful passengers who disembarked from Airwork's Safari-service Viking at Blackbushe last Friday were Asmani Saidi and Panya Sefu, ex-Askaris, who flew to this country to represent the Tanganyikan Branch of the British Legion at the Armistice Rally. They were accompanied by Capt. C. Bone (left), chairman of the Legion's African section, and welcomed by Maj. B. A. Wilson of Airwork,

EXECUTIVE LINE-UP: Members of the Hawker Siddeley mission photographed during their recent visit to the Malton, Ontario, works of A. V. Roe Canada, Ltd., some of whose officials are also in the group. The mission returned to this country on October 27th. Names, left to right, are:— W. F. Saxton (Armstrong Siddeley director and general manager), R. Jones (chief metallurgist, High Duty Alloys), Dr. L. W. J. Newman (A.W.A. chief engineer, armaments), R. W. Walker (Gloster chief designer), H. R. Watson (A.W.A. aircraft chief designer), J. Lloyd (A.W.A. technical director), Sir Sydney Camm (Hawker chief designer and director) with Jim Floyd (aircraft chief designer and chief engineer, Avro Canada) just visible behind him; Sir Roy Dobson (Avro managing director and chairman of the Canadian company), S. D. Davies (Avro chief designer), Sir Frank Spriggs (Group managing director), W. H. Lindsey (A.S. chief engineer and director), Sir William S. Farren (Avro technical director) and Crawford Gordon, Jnr. (Avro Canada president and general manager).

HERE AND THERE

Atoll Atomics Again?

UNOFFICIAL reports from America suggest that a new series of atomic-bomb tests is to take place, either at Eniwetok or Bikini, next spring. The hydrogen bomb is mentioned.

Opportunity Missed?

THE New Zealand Government has declined a British Government offer of a Canberra for high-altitude and meteorological research. Mr. Thomas Macdonald, Minister of Civil Aviation, is reported as having refused the offer on the grounds of "maintenance difficulties, and operating costs understood to be at least £230,000 sterling a year."

Premature

RECENT newspaper reports have implied that Neville Duke is shortly to make another attempt on the world air speed record with the red Hawker Hunter. There is little foundation for this story; it arose, we believe, from remarks by a Hawker spokesman to the effect that the company remained interested in the record and might next year consider another attempt if and when a suitable engine became available.

America's Spanish Bases

REPORTS that atomic bombs would be stored at the air bases which America is obtaining in Spain were denied last week by Mr. Dulles, U.S. Secretary of State. The statements had been attributed to Mr. Harold Talbott, Secretary for Air, who had been inspecting the airfields.

Egyptian Venture

THOUGH its title—Compagnie des Engins à Réaction pour Vol Accéléré—sounds fairly specific, a new company formed in Cairo is (according to a *Financial Times* report) to engage in the manufacture of arms, explosives, aircraft and engines, and to conduct mineral and metallurgical prospecting and mining.

On Airline Efficiency

GUEST speaker at the third Efficiency Luncheon—to be held at the Holborn Restaurant, London, on November 26th—will be Mr. Peter Masefield, B.E.A.'s chief executive; he is to talk on *Getting the Most out of Air Transport*. Tickets for the luncheon, price 13s, may be obtained from Efficiency Magazine, Ltd., 87, Regent Street, London, W.1.

CF-100 Simulator

A FLIGHT-SIMULATOR for the Avro Canada CF-100 is being produced to an R.C.A.F. order by Canadian Aviation Electronics, Ltd., of Montreal, P.Q. The simulator will be able to reproduce all flight conditions and possible emergencies, and will, it is claimed, render pilot-training 20 times less expensive than full-scale flight training.

Aircraft-Tyre Appointment

FOLLOWING changes in the organization of the tyre technical department at Fort Dunlop, Mr. H. R. Fletcher, formerly aircraft and racing car designer, now becomes manager of the aircraft tyre division; he is directly responsible to Mr. L. E. Masheter for all technical aspects of aircraft tyre and tube manufacture.

Europe's Biggest Refinery

DESIGNED by Shell, and built in just over a year at a cost of £2 million, a new distillation unit is now "on stream", for an output of 3½m tons a year, at the Pernis refinery near Rotterdam. The refinery is now Europe's largest, with a "crude" capacity of 10 million tons a year.

Hiller Executive

REJOINING Hiller Helicopters, now as chief engineer, is Robert A. Wagner. Originally with Hillers, he joined the helicopter division of Hughes Aircraft, where he was in charge of testing the big jet-powered XH-17; in 1951 he became chief engineer of the aircraft division of McCulloch Motors.

Tenth Wing

ANOTHER U.S.A.F. transport wing is to be transferred to Europe, reinforcing the nine tactical and transport wings already there. This will be the 465th Troop Carrier Wing, equipped with Fairchild C-119s, at present at Donaldson A.F.B., South Carolina. Two squadrons will be based in Germany, and the third, with the headquarters organization, will be stationed in France.

PRECISION PARACHUTISTS: If Soviet Russia is reluctant to release pictures of her aircraft, she is slightly less secretive about personalities. Here are the three parachutists whose claim for a precision-landing jump was—as reported recently on this page—confirmed by the F.A.I. Jumping from an aircraft at 600 m (1,968ft) they alighted at an average distance of 40ft from the spot-mark. Left to right, they are: I. Fedchishin, P. Storchienko and P. Kosinov.

WHERE A.T.A. LEFT OFF

—*Royal Air Force Ferry Units Took Over: A Visit to Aston Down*

By DAVID F. OGILVY

AFTER the end of the war—and with it the disbandment of the Air Transport Auxiliary—the number of Service aircraft requiring to be ferried was greatly reduced, yet the task remained an essential one. How many people have ever troubled to think who has been carrying on with the good work over the last seven years? During this period nearly all squadrons and training schools of the R.A.F. have been re-equipped at least once and a change of this nature involves not only the delivery of the new machines but also the collection of the old.

In peace-time the responsibility for shuttling aeroplanes from one station to another naturally rests with the R.A.F. itself, and although it is not uncommon for squadron aircrews to carry out their own removals from time to time, an organization has been set up specifically to make collection a smooth and straightforward process without the need for calling on these sources. Three R.A.F. ferrying units now exist in this country, at Hawarden, near Chester; at Aston Down, in Gloucestershire; and at Benson near Oxford. The last deals exclusively with overseas work, including the collection in easy stages of Sabres from the other side of the Atlantic.

We are concerned in this article primarily with Aston Down, which for geographic reasons deals with the southern half of the U.K., while Hawarden caters mainly for the needs of the North. Although the station is principally a maintenance unit with many types in storage, from Chipmunks and Tiger Moths to Lincolns and Hastings, most of the flying is carried out by the ferry pilots, as the M.U. appears to handle only a very limited number of daily movements.

No. 2 Ferry Pool, as it was known originally, came into active existence in September 1945, under the command of S/L. W. Cooke. Although the nature of the work performed has remained the same throughout, there have been changes of both name and centres of administration. Maintenance Command was the guiding light for the greater part of the time, but has given way within recent months to Transport Command; the word "pool" was abandoned in favour of "unit"; and, more recently still, the status has been altered to that of a squadron. Currently the number is 187, a unit which in its earlier rôle was disbanded at the end of the war; action with Dakotas at Arnhem had been its main claim to fame.

The resuscitated 187 Squadron now operates under S/L. G. Smythe, M.B.E., D.F.M., who has F/L. Cooper as "A" Flight Commander and F/Lt. Kudrewicz in charge of "B" Flight. Although "A" deals primarily with the heavier material and "B" with fighters and light types, the dividing line is imaginative; subject to the limitations on the classes that he is entitled to handle, a pilot flies anything that needs flying.

Broadly, the work entails collecting new aircraft from manufacturers' airfields and stored or reconditioned machines from M.U.s, with, usually, the return to M.U.s of the replaced equipment. Depending on type and age, the last-mentioned aircraft are then stored, overhauled or broken up, according to the needs of the Service. Heavier types, in many cases, have their control surfaces removed and are then left in the open to await their respective fates. A few, however, are preserved by one of the protective processes, but at present this is more in the nature of an experiment than a serious attempt at saving actual airframes that are known to be wanted for further use; a small bunch of Tempest 20 and Lincolns is being used as guinea-pigs.

Each morning in the operations room (clearly marked "Out of bounds before 1100 hours") the day's task is worked out according to the number and types to be moved, the weather and the availability of aircrews. A large-scale map is mounted on a table, under a glass cover on which a chinagraph pencil is used to mark the routes to be flown, the tracks being drawn in various colours for ease of reference and crew selection.

Obviously, with aircraft in need of collection and delivery at aerodromes spread far and wide over the country, it is necessary to provide transport for the pilots betwen Aston Down and these airfields, so No. 187 squadron operates a fleet of six Ansons for the purpose. Each pilot takes his turn "on the airline" and often one of the Annies can be seen taking off in determined pursuit of a Meteor to pick up the latter's pilot from its destination.

Naturally, with such a large variety of types in service, the unit may be called upon to ferry anything from an Auster upwards, so only men with considerable experience are employed. As a fair average each man has about 2,000 hours on 20 or more types, so jumping in and out of machines of widely different calibres does not present such a problem as it would for the average pilot on an operational squadron, who over a period of two years or more may handle only one or two types. For this reason No. 187 endeavours to keep its members for as long as possible, one example of this policy being F/Sgt. Gorny, who has been ferrying for five years and who recently was awarded the A.F.M. for his work.

Some pilots will remember that, to become useful in any particular service rôle, they underwent a course at an A.F.S. to convert to a type and then followed this with a similar period at an O.C.U. to put that experience to practical use. They may wonder how a man can change from one type to another with comparative ease and still obtain the best from his aeroplane. The answer, of course, is that a ferry pilot is not called upon to put his mount to its maximum use; his job requires him to *fly* rather than to *operate* whatever comes along.

An example may clarify this observation. A fighter pilot operating on Meteors requires an extensive course before he can be of use to a squadron, and this applies whether he has just emerged from his F.T.S. or if he has completed a tour on, say, Spitfires and another on Lincolns. He will be required to practise high-speed controlled descents, runs at limiting Mach numbers, tactics to employ with high closing-speeds; and he must learn how to use his particular airframe and engines to obtain maximum benefits in range and endurance, and a host of other tricks peculiar to his task.

However, a man with his Spitfire and Lincoln tours behind him —and in the main these are the people chosen for ferrying—will find *handling* a Meteor ridiculously easy. The broad principles underlying the flying of an aeroplane remain the same regardless of type, although some pilots of limited experience fail to acquire that adaptable train of thought and have peculiar ideas about the necessity for "conversion" when anything appears slightly different from the usual. All that one *must* know is how to start the engines, plus a few figures such as limiting jet-pipe temperatures and over-the-fence speeds, although even the last-mentioned is not essential knowledge given good enough weather in which to experiment upstairs. Armed with this information and a fair share of good fortune (such as freedom from mechanical failures) it is possible to deliver an unfamiliar machine from A to B.

The R.A.F. is not, of course, as casual as this, and the example is not intended to imply that this should be so; it merely serves to make a comparison between the two extremes of handling and operating. In practice, of course, certain limitations are imposed on the individual and periodical checks made to ensure that he maintains a sufficient standard, which is as it should be if not taken to impracticable limits.

Until comparatively recently, Aston Down pilots were permitted to fly anything within the scope of their basic capabilities and for several years this proved a successful method of operation; however, and supposedly in the interests of increased safety, Transport Command introduced numerous restrictions in the categories of machine that any one pilot could handle; and they

Planning for most economical use of crews is an important side of the day-to-day organization of ferrying duties: briefing pilots at Aston Down.

WHERE A.T.A. LEFT OFF . . .

imposed a maximum limit of three months, outside which a further check on type became necessary before ferrying could be resumed. A training unit is maintained at Benson for this purpose.

For delivery duties, therefore, five classes have been instituted; they cover singles, jets, fast twins (i.e., Mosquito, Beaufighter, Hornet, etc.), heavy twins (Dakota, Varsity, etc.) and four-engined equipment. At present, with the exception of the C.O. and his two flight commanders, each pilot is allowed clearance for only two classes; but it is hoped that a happy medium a little nearer the earlier freedom will be reached before long.

In a job of this nature it is difficult to amass any great monthly total of hours, for the average delivery flight takes probably something approaching 45 minutes; a far greater amount of time is spent as a passenger in the back of one of the unit's Ansons. This is explained by the fact that normally it is necessary for the pilot to be taken to the point of departure, and fetched from the aerodrome of delivery, for each actual ferry movement. He can, however, compensate for the lack of ferrying hours when his turn comes to fly an Anson (this usually works out at every fourth or fifth working day), for a "round the houses" route for each machine averages between three and four hours. During this time it is usual to call at five or six stations, dropping and picking-up "bodies" as required.

As a location, Aston Down is not absolutely ideal for its purpose, because it is apt to suffer from sudden and unpredictable weather changes, due to the peculiar nature of the Gloucestershire countryside (attractive though that is) and the proximity of the mouth of the Severn; all of which leads to mist and fog when least expected.

As an airfield, the home of No. 187 Squadron is adequate if not over-generous in dimensions for jet aircraft. The grass is serviceable and sometimes is used by machines of the Tiger Moth and Chipmunk calibre. However, it is not the home base that normally concerns the pilots in the course of their duties; more usually it is the private or manufacturers' aerodrome near which fast Service aircraft are built or repaired and which was never intended to cater for such types. The writer's own limited experience of flying Mosquitoes in and out of Cambridge when the grass surface was wet is sufficient to make him appreciate the degree of skill demanded of Aston Down personnel—especially as, apart from the permanent hazards, there may be no wind to assist the operation! Sywell, where Mossie B35s are converted to heavily-laden target tugs, is another example and perhaps an even trickier one.

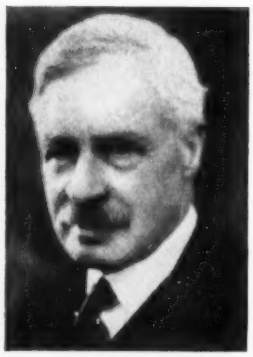
As many of the movements pass through Aston Down *en route* to their eventual destinations it is not surprising that No. 187 can muster an interesting array of types, and a formation tried successfully in rehearsal for the Battle of Britain display was more varied even than that put up by the Central Flying School at Little Rissington in 1952. Led by a Hastings, with an Anson and Varsity holding Nos. 2 and 3 positions respectively, a Meteor and Vampire clung to the outsides of the vic, while a Spitfire flew in the box to complete the sextet. Unfortunately, eleventh-hour unserviceability on the Hastings and the Vampire compelled the formation to be cancelled on the day of the show; but a mid-week practice flight looked very impressive from the ground.

Since 1946 Aston Down pilots have ferried 16,400 aircraft in flights involving a coverage of 4,500,000 miles and amounting to 26,300 flying hours. As a meaningless but nevertheless amusing aggregate of the speeds of all the machines flown from, say, the Tiger Moth to the Canberra, this results in an average ground-speed of 175 m.p.h., including time taken on take-off, circuit and landing.

Finally, one feels impelled to add that the ferry pilots of the R.A.F. must have one of the most interesting jobs available in the Service—that is, for those who appreciate the more pure forms of flying, for this is one of the few tasks in modern aviation where aircraft-handling and map-reading take precedence over Mach-meters, gee-boxes, Rebecca/Babs and all the complexities of serious all-weather operation without which, alas, a fighting force is quite useless.

A PIONEER OF THE INDUSTRY

ALTHOUGH it is now some 15 years since Lord Kenilworth (formerly Sir John Siddeley) was actively concerned with the Armstrong Siddeley business, the news of his death in a Jersey nursing-home on November 3rd must have been received with a sense of profound regret by many of the older members of the automobile and aircraft industries.



Lord Kenilworth.

Born in 1866, John Davenport Siddeley entered the motor industry at the beginning of the century. In 1902 he designed a car, which three years later was marketed as the Wolseley Siddeley; then, in 1908, he broke away from the Wolseley organization and, in partnership with Maj. H. P. P. Deasy, manufactured the Siddeley-Deasy. It was during the World War I that the Siddeley-Deasy works first began aircraft manufacture, building R.E.8 and other airframes and the B.H.P. engine, later to become famous as the 240 h.p. six-in-line Siddeley Puma; this engine was followed by the Tiger, a virtual duplication of the same unit into a vee-twelve. At the end of the war, Sir W. G. Armstrong Whitworth and Co., Ltd., acquired an interest in the company, and the name Armstrong-Siddeley was established. Early in the 1920s the firm went into production with the Lynx and Jaguar air-cooled radials based on 1917 designs; with other engines, likewise, nearly all known by names of wild cats, they established a line of development that gained increasing fame for the company throughout the inter-war years. In airframe design, also, they pioneered the Siskin, later to achieve a great reputation as an Armstrong Whitworth type; another Siddeley type was the big Sinaia biplane, powered with two Tigers. The Armstrong Siddeley Company was absorbed into the Hawker Siddeley Group in 1923.

John D. Siddeley was knighted in 1932 and raised to the peerage in 1937. He was chairman of the S.B.A.C. from 1931 to 1933. He married in 1893, and all who knew Lord and Lady Kenilworth recall them as a particularly devoted couple—so much so that his own death only a fortnight after that of his wife was hardly a surprise. The title now passes to the eldest son, Lt-Col. the Hon. C. D. Siddeley.

NUCLEAR WEAPONS PROGRESS

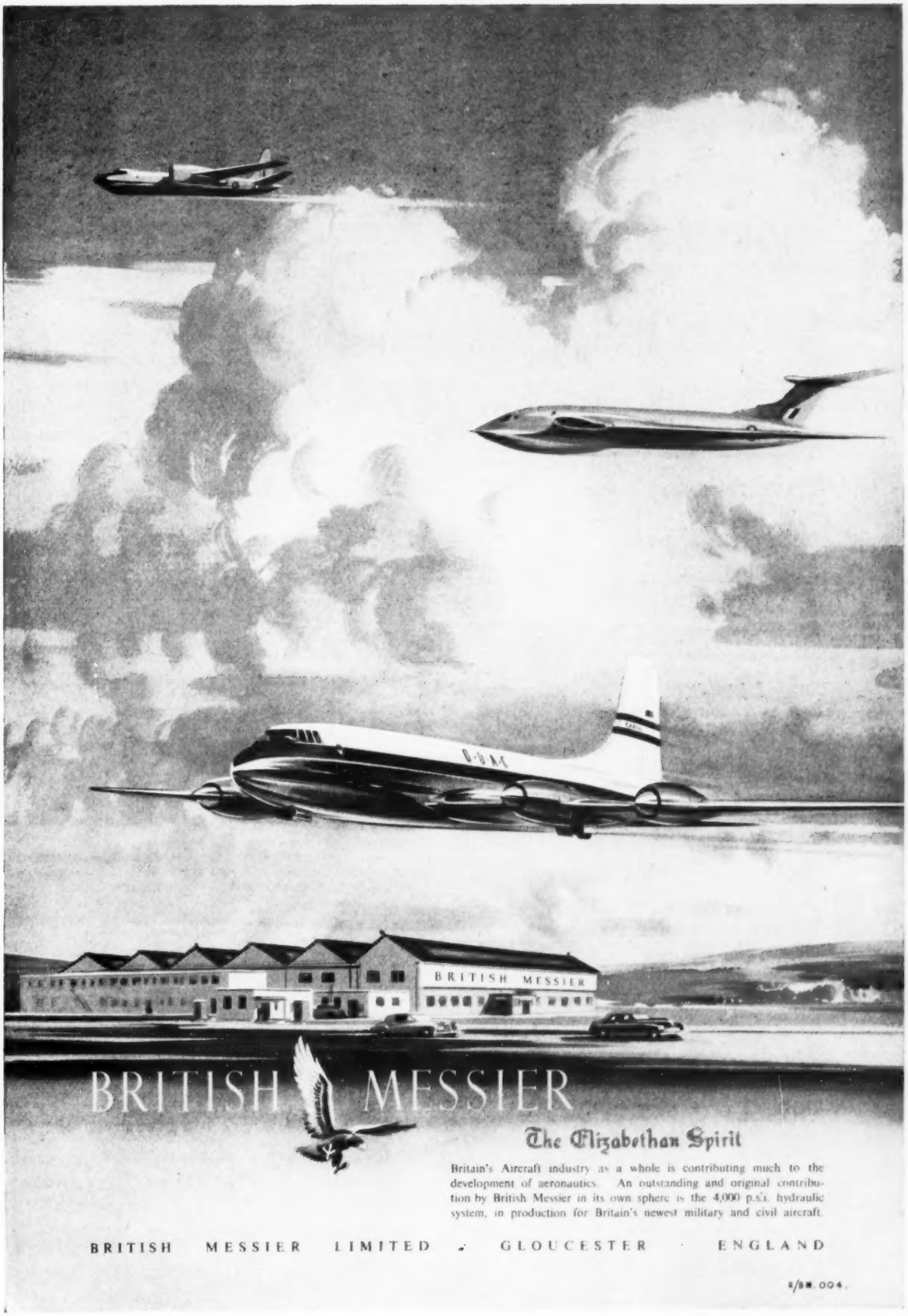
IN a statement following the recent series of atomic tests in Australia, Professor E. W. Titterton, of the department of nuclear physics of the Australian National University, said that Britain could now supply atomic weapons for use by all three Services. Apart from the normal technique of dropping from aircraft, atomic weapons could be delivered by rocket, guided missile, ship- or submarine-borne cannon or by submarine. Nor were they any longer the equivalent of the "standard measure of 20,000 tons of T.N.T.," but had many forms and powers.

ARMSTRONG SIDDELEY APPOINTMENT

UNTIL recently Director of Maintenance and Repair at the Admiralty, Rear-Admiral G. C. Ross, C.B., C.B.E., has joined Armstrong Siddeley Motors, Ltd. In his new post he will act as liaison officer between the company and the Admiralty, and he is also to look after certain details of A.S.M.'s export business. George Campbell Ross, who is 53, was, until his recent retirement, one of the Navy's senior engineer officers; he had also been an A.D.C. to the late King George VI. He joined the Navy in 1913, served with the Home Fleet as an executive officer in World War I, afterwards transferring to the Engineering Branch. He served five years on the China and East India stations up to 1929 and, after promotion to commander, was Assistant Naval Attaché at Tokio from April 1933 to July 1936. He was with the Engineer-in-Chief's Department of the Admiralty at the outbreak of World War II, but in December 1941 he became Squadron Engineer Officer in H.M.S. *Nelson* and saw action with Malta convoys off North Africa and Sicily.

Rear-Admiral Ross.

He was promoted captain in June 1943, and held the post of Deputy Director, Aircraft Maintenance and Repair Department, Admiralty, from December 1943 until December 1947. From then on he was Chief of Staff to the Rear Admiral, Reserve Aircraft, until promotion came again, with appointment in November 1949 to the post from which he has now retired. Admiral Ross, who is married, lives in Chelsea. His hobbies are fishing and painting.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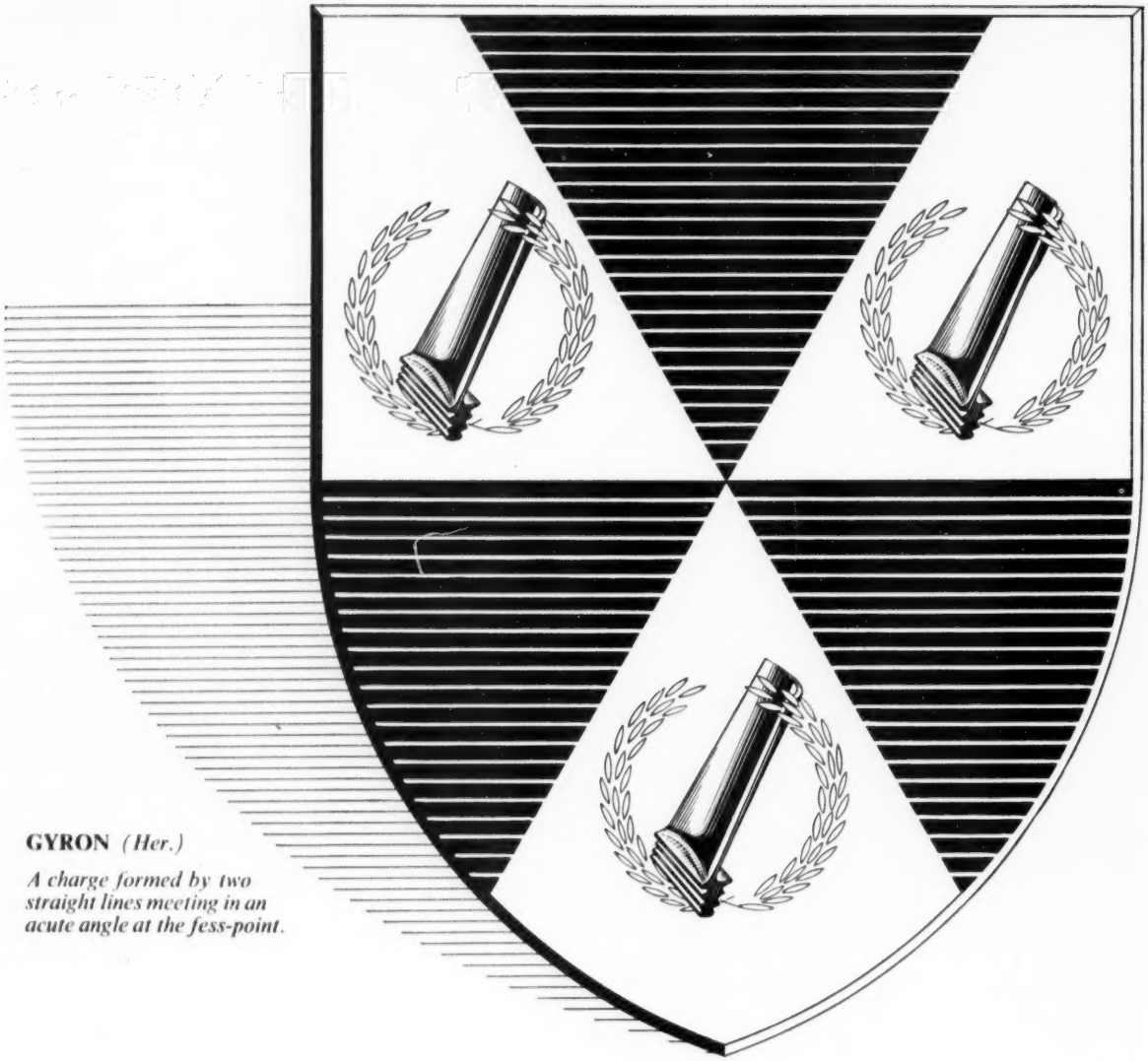

GYRON *(Her.)*

A charge formed by two straight lines meeting in an acute angle at the fess-point.

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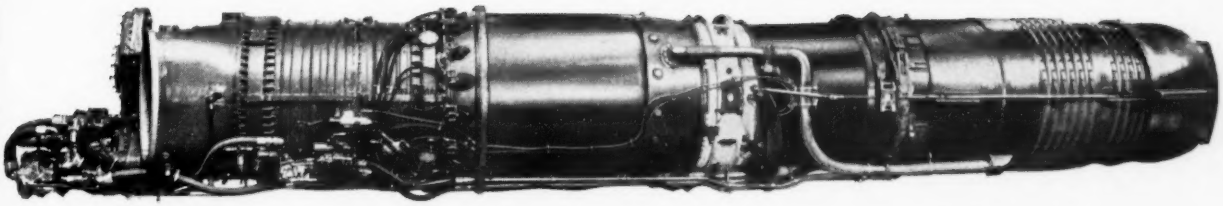


WESTINGHOUSE TURBOJETS

Some Notes on the U.S. Navy's Principal Aircraft Gas Turbines

DURING the past year we have made several references to the difficulties being experienced by the Westinghouse Electric Corporation of America with their more recent aircraft power units. Very little has been published in this country about the engines themselves, and this is a short account of their development and characteristics.

Westinghouse have long been famous as manufacturers of heavy electrical equipment and, in particular, of the main propulsion machinery for warships. The U.S. Navy Department have always held the company in high esteem and, in December, 1941, the Bureau of Aeronautics asked them to design a turbojet for future Navy fighters.

From the start, the axial type of compressor was chosen. When the first engine appeared in 1943, it was hailed as the first American gas turbine free from foreign (i.e., British) influence. Whether this was an advantage or not, Westinghouse did an excellent job in those early years in laying the foundations for an entirely original line of small-diameter turbojets quite unlike any others.

The first production engine was the 19XB-2B, 261 of which were built (130 by Pratt and Whitney) for the McDonnell Phantom. In service, this engine was known as the J30-WE-20, and it passed its 150-hour test in November, 1946. It had a ten-stage compressor and gave 1,550 lb sea-level static thrust. Two notable features of the engine were the annular combustion chamber — consisting of two tapering stainless-steel tubes mounted concentrically, with a large number of downstream burners injecting into the annular space between them—and an oil cooler which was fabricated from rectangular-section aluminium tubing wrapped around a mandrel of the same diameter as the engine intake and then attached to the front of the engine to be cooled by the intake air.

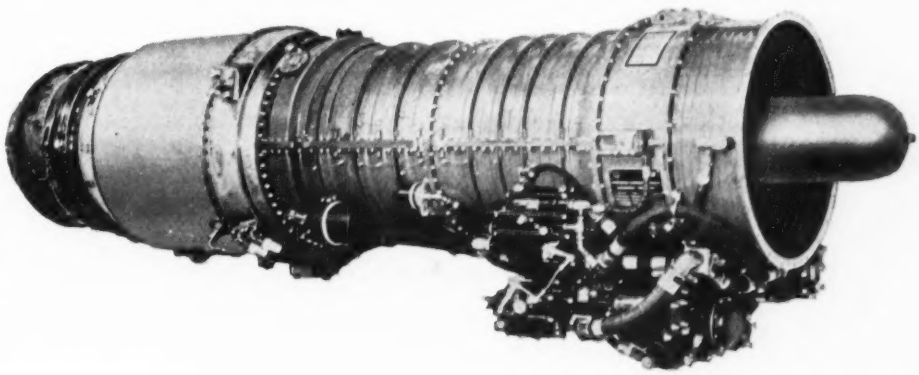
The second, and most widely-used Westinghouse engine so far is the Model 24 (U.S. Navy designation J34), large numbers of which have been built for such aircraft as the Douglas Skynight and McDonnell Banshee. Apart from being the largest of the original Westinghouse range of three engines, the J34 employs an extra stage of compression and an additional turbine. But indicative of the poor state of the art at the time the engine was designed (about 1945) is the fact that even with 11 stages the pressure ratio is only 3.85 : 1, raised to 4.35 in the latest version. As a direct result, the specific fuel consumption is no better than can be obtained with a centrifugal compressor. The J34 has worked quite well during the past five years, and has also been supplied to the U.S. Air Force, both with and without an afterburner. It is gradually passing out of major production, but remains the most rewarding engine the company has produced.

The direct descendant of the J34 is the J46, which is about half as big again in linear dimensions. The J46 was to have powered several Navy fighters, including the swept-wing F3D-3 Skynight, which was cancelled. Now, however, only two aircraft are scheduled to receive the engine: the Chance-Vought F7U-3 Cutlass and Convair F2Y Sea Dart. Westinghouse have experienced much trouble with the J46, notwithstanding its similarity to the J34. The engine is already months, or years, behind in its type-test programme and deliveries of cleared engines have been no more than a trickle. The speedy, but frightening, Cutlass has been held up seriously as a consequence, and much of the test flying has been carried out with two Allison J35s. The Sea Dart has not, we believe, been retarded greatly, and the prototype now flying is fitted with two afterburning J34s. But, if the J46 continues to give trouble, a serious bottleneck could develop, because no replacement engine has the same geometry.

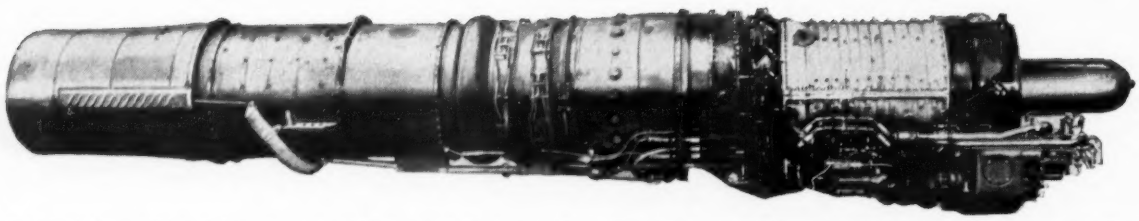
Far more important than the J46 is the J40, which passed its type-test in 1951. At that time, several fine, supersonic Navy prototypes were about to fly, and the J40 was scheduled as the power unit of every one. The engine is a completely new design, able to pass about three times the airflow of the J34 to give nearly three times the thrust. As with almost all other engine manufacturers, Westinghouse turned to the lengthy, small-diameter, low-revving axial layout in an effort to obtain increased power.

The J40 is quite different in detail from almost any other engine, and marks a notable advance on previous Westinghouse practice. The quite good compression ratio, achieved with only ten stages, is reflected in the reasonable specific fuel consumption (see table, p. 642). Most J40s have bifurcated intakes with a number of fuel and control accessories mounted below and forward of the ducts, as shown in the photograph. From the front, notable features of the engine are as follows:

There are twin oval intakes separated by a wheel-case upon which can be mounted pads for accessories. The intakes themselves are de-iced by air bled from the delivery end of the compressor. The compressor casing consists of two forward halves of aluminium alloy and two rear (high-pressure) halves of steel. The rotor contains ten steel discs and all the fixed and moving blading is also of steel. The annular combustor is of the "step-



The J40-WE-8 at the head of the page is reminiscent of a turbo-alternator set for a power station; its appearance suggests that installation must raise some acute problems. The smaller engine on the right is a typical J34, as used in the Skynight and Banshee. The cylindrical oil-cooler around the intake is visible and is referred to in the text.



The Westinghouse J46 probably sets a record fineness-ratio for aero engines. The afterburner eyelids are, as in the J40, actuated by means of a lengthy linkage which is evident in the photograph. Some J46s are now beginning to pile up flight-time.

WESTINGHOUSE TURBOJETS . . .

wall' type, in which concentric rings admit compressor air to cool the perforated flame-tubes. Sixteen duplex burners are fitted, fed at 600 lb/sq in from a dual Pesco gear pump, *via* the mass of flexible hose which covers the rear of the compressor case. The turbine nozzle guide-vanes are hollow with forced-air-cooling, and the two steel turbine discs, which are similarly cooled, are bolted together around their periphery and carry solid inserted blades of a stellite-type alloy. Behind the turbine is attached a huge afterburner by means of a flexible joint and quick-release connection. The afterburner fuel lines can be seen along the bottom of the engine and they inject mid-way along the reheat pipe. Finally, the jet booms out through sideways-opening eyelids actuated *via* about 14ft of push-pull rod and a yoke-piece by an electric screw jack mounted under the turbines.

The first and lasting impression is of immense length, and we believe no other engine currently running exceeds the afterburning J40 in this respect. But length is no virtue in aero engines: it is almost as important to keep the length down as it is to reduce frontal area. There seems little doubt that the engine could be telescoped into a smaller space, so allowing air to get in and out in a reasonable time. This should offer important secondary gains to the aircraft in which the engine is installed.

But the J40 has been virtually eliminated from U.S. Navy procurement programmes. Such a step was not taken without a most searching examination, and we know the failure of the J40 has been a bitter disappointment to the Bureau of Aeronautics no less than to Westinghouse. Endless troubles with the engine have delayed such important aircraft as the Douglas F4D Skyray, Douglas A3D, and McDonnell F3H Demon, while substitute engines were found and installed. In many cases, the Pratt and Whitney J57 took over, and in others the Sapphire. But Westinghouse are far from through with aero engines.

Earlier this year an agreement was signed with Rolls-Royce providing for technical co-operation for a period of up to ten years, involving an interchange of knowledge and limited exchanges of personnel. Also, if the occasion warrants such a procedure, either company can manufacture, under licence, engines developed by the other. At present, the liaison is working happily and appears likely to benefit both companies.

One can never ascribe engine development difficulties to a single problem. In the case of Westinghouse, who have probably had a worse time than any other power-plant manufacturer in recent years, several factors have militated against their turning out completely satisfactory engines. For one thing, it is not always a good move for a company renowned in one sphere to try its hand at development in another. Modern gas turbines are rather a law unto themselves and require more "know-how" than may at first be appreciated. Again, Westinghouse may not have been able to attract all the gas-turbine specialists it wants, although the position in this regard may have improved following the opening of the company's Kansas City plant, with its attendant aero-engine research facilities divorced from the company's other spheres of influence.

But whatever the future holds for Westinghouse, the company can take heart in one fact shining like a star against the stormy sky—their J40 (in the Skyray) is the engine which at present holds the world speed record.

Engine	Layout	Pressure Ratio	Approx. overall dimensions (in)		Dry weight (lb)	Max. sea level static thrust (lb) and r.p.m.	Specific fuel consumption lb/hr/lb	Applications
			Length	Diam.				
J30-WE-20	10-A-1	3.8:1	101	21	705	1,550 at 17,000	1.18	FH Phantom
J34-WE-36	11-A-2	4.35:1	112	27	1,207	3,400 at 12,500	1.04	F3D-2 Skyknight, F2H Banshee
J40-WE-6	10-A-2	—	192	40	3,000	7,500 at 7,600	0.95	A3D prototype
J40-WE-8	10-A-2	—	300	40	3,500	10,500 at 7,600	2.2	F3H Demon, F4D Skyray, F10F Jaguar
J46-WE-8	11-A-2	—	198	36	2,100	6,000		F7U-3 Cutlass, F2Y Sea Dart

EXPANSION IN CANADA

IT may be recalled that eighteen months ago we published an important series of articles on the Canadian aircraft industry. Since that time expansion has continued steadily, and the opening of new factories, or the extension of existing ones, makes news almost weekly. Particularly is this true of the plants operated by Canadian subsidiaries of British firms; an informative summary of the current position has lately been issued by the S.B.A.C., and at the risk of repeating facts that have recently appeared in these columns, we summarize some points from it.

Two new factories (Bristol and Dowty) have recently been formally opened, two more (Rolls-Royce and Lucas-Rotax) are in production, and a third, Avro Canada, has acquired a $17½m plant from the Canadian Government.

Altogether, there are about 40 companies closely associated with parent concerns in Great Britain. Five are members of the S.B.A.C., which has eleven Commonwealth members altogether. The expansion of these companies is closely related to Canada's policy of producing her own strategic defence material, as well as being concerned with the day-to-day after-sales service of their products. In more detail, so far as several of the firms are concerned, the present position is as follows:—

de Havilland Aircraft of Canada will be moving soon from their old Downsview plant to a new 600,000 sq ft factory nearby; and the Fairey Aviation Co. of Canada, comparative newcomers, are building an extension to their factory near Halifax, Nova Scotia, of some 208,000 sq ft and a further 160,000 sq ft is also planned.

Rolls-Royce have a new large factory near Montreal for the servicing and, eventually, production of their engines. The first stage in this programme will be the servicing of Nenes built in Britain for the Canadair-built T-33 trainer.

Dowty Equipment of Canada recently formally opened a 60,000 sq ft factory at Ajax, Ontario, 20 miles east of Toronto, and another important new accessory factory is also in action at Scarborough, near Toronto—the Lucas-Rotax plant. This has a floor space of some 120,000 sq ft and is to employ about 1,500 people in the production of such items as turbo-starters and electric starters.

There is also the small but well-equipped factory of Sir George Godfrey and Partners in Quebec, producing pressurization equipment. Finally, Field Aviation (at Oshawa, Ontario), Hunting Group associates, do extensive servicing of R.C.A.F. aircraft, and also sheet-metal and other sub-contracted work.

"GRADS AND STUDENTS" RECEPTION

AS on the corresponding occasion last year, the excellent modern music in the library of the Royal Aeronautical Society was the best part of the reception and dance organized by the Graduates' and Students' Section on October 30th, providing a not unpleasant change from the learned discourses more customarily heard therein. Some 150 graduates, students, friends and guests were present, including Dr. Ballantyne, Mr. E. B. Dove, Mr. N. J. Hancock, and Mr. Walter Tye.

As should be the case on a social occasion, aeronautical shop talk was relegated to the background, although one could take advantage of lapel badges to identify this year's crop of committeemen. Pleasing selections of films and refreshments were provided, and the only fault in organization lay in the unnecessarily early time at which such an enjoyable evening had to end.

MAN-TO-MAN TALK-DOWN

—*The Ekco Approach Aid Type CE 71 in Operation*

AS he plunges once more into the slough of British winter weather, many a pilot finds himself expending nervous energy in speculations concerning approaches and diversions. All too often at this time of the year those pilots who cannot normally claim the support of all the ponderous machinery of flight control in I.F.R. conditions, are firmly "grounded" by low cloud and poor visibility, though weather above, say, 3,000ft may be ideal; or, perhaps, having started unscheduled point-to-point flights, they find themselves harassed by "clamps" which partially close in airfields of destination during transit. It is in such circumstances as these that the Ekco approach aid is particularly useful at the smaller civil airfields not equipped with comprehensive (and expensive) facilities. A member of *Flight's* staff recently had the opportunity of seeing the Ekco equipment in operation in just the conditions outlined above.

The opportunity arose when Southend Municipal Flying School's Gemini took off at dusk for G.C.A. practice; the cloud base was eight-eighths at 1,300ft, with tops at 3,000ft. Visibility below cloud was obscured partly by gathering darkness, partly by radiation-fog which had already formed in the valleys around Southend. In fact, details were indistinguishable beyond a few hundred yards' range. A gooseneck flare-path laid on the grass runway, two sodium lights marking the threshold, and red obstruction lights on a church and a large house on the approach; all these were invisible at 800 yd.

Yet in these conditions a series of accurate and comfortable approaches was carried out. With simple V.H.F. R/T. in the aircraft, normal control-tower facilities and the Ekco one-man G.C.A. equipment, the Gemini was repeatedly brought in to the transition point from which it was in each case possible to make successful touch-downs. The Gemini was first homed over the airfield by V.H.F. D/F. and then picked up and identified by the G.C.A. controller with his own D/F. and radar beam. At this point the Gemini was flying at 1,500 to 2,000ft. I.F.R. A base leg was flown and the operator passed QNH, runway details and instructions for undercarriage and flap settings.

When the turn on to the cross-wind leg was made, the ground was in sight vertically below; but horizontal visibility was limited to a few hundred yards. It was not until the aircraft was well settled on its glide-path, at a rate of descent of 300ft/min, that the ground became clearly visible; even then, the airfield was indistinguishable in the dusk and patches of mist. Following normal G.C.A. procedure, final checks were called, heading and height corrections passed, and obstacle-clearance break-off height given (300ft). At three-quarters to half a mile from touch-down, the flare-path was dimly visible, and the sodium threshold-markers came into view. At between half and a quarter mile from touch-down the controller called "look ahead and land."

On this occasion the G.C.A. operator was under training. With practice, it is possible to bring the aircraft practically down to the hold-off point with very little visibility. This was in fact accomplished on one occasion when ground fog had suddenly formed on the airfield. Larger aircraft, such as Dakotas, have also successfully been talked down.

These talk-downs, in which the procedure corresponds almost exactly to that of the full-size G.C.A., are accomplished with compact, simple equipment, costing just under £4,000, operated by one man and housed in a normal Service-type caravan. It consists, in fact, of a combination of a 3 cm radar installation with a V.H.F. D/F. receiver, the radar dish being mounted on a common rotatable shaft with the D.F. aerial, so that the axis of the beam coincides with the null direction of the D.F. aerial. The radar dish is permanently linked in azimuth to the D/F. aerial, but is independently controllable in elevation. Thus, the radar pencil beam can be trained on the aircraft with the D/F. and elevated as necessary to secure positive radar contact. The radar display is a simple "A" scope presentation, calibrated in nautical miles in two ranges, 0 to 4 and 0 to 16. Two scales show the position in azimuth, and elevation of the dish aerial. A series of adjustable contacts operated by cams on the scale-drives illuminate lamps beside the "A" scope to indicate whether the aircraft is on the glide-path and on track. A microphone and loudspeaker mounted on the set cover R/T. communication. The whole equipment is manually swivelled by a "handlebar" so that the operator faces the aircraft being followed. The aerial is elevated by twist-grips on the handlebar, and the D/F. sensing switch is operated by one thumb.

The simplicity and compactness of the Ekco Type CE 71 equipment is clearly shown in these illustrations. The radar and V.H.F./D.F. aerials are mounted on a common shaft with the rotating main unit inside the caravan. The set is manually swivelled by the "handlebar" as shown in the lower illustration, and very little space is required for the whole installation.

The equipment is extremely simple, but completely efficient. Although obviously not capable of handling a stream of traffic, it is quite adequate for the needs of an airport such as that at Southend. For a cost which must be a fraction of that of full-scale G.C.A., approaches of the same type and of equal accuracy can be achieved.

The dimensions, weights and power requirements of the Approach Aid Type CE 71 are as follows. The body of the rotating rack assembly measures 4ft high x 2ft 1in wide x 2ft 3in deep; the assembly requires a distance between floor and outside roof of 6ft 10in. The weight of the complete assembly, including aerials but excluding R/T. communication equipment, is approximately 600 lb. The floor-standing rack, normally supplied with the equipment and housing the control unit and R/T. communication equipment, measures 4ft 4in high x 2ft 1in wide x 1ft 8in deep, and weighs approximately 300 lb. The mains voltage stabilizer is a separate unit measuring 2ft 4in x 1ft 3in wide x 1ft 4½in deep, and weighs approximately 165 lb.

The complete installation comprises the following 15 units: The rotating rack assembly, with radar and D/F. aerials, which houses the following seven items: indicator unit, 3 cm transmitter/receiver, indicator power unit, transmitter/receiver power unit, D/F. receiver, D/F. receiver power unit, and distribution unit; then the mains voltage stabilizer and the mains transformer unit; and finally the 4ft floor-standing rack housing the control unit, R/T. transmitter, R/T. receiver, and the R/T. receiver power unit.

The equipment is available for operation from standard mains or locally generated supplies.

CRUSADER COACH

Stansted-Nicosia by Skyways

A Skyways York, airborne from the company's Stansted base.

PROVIDED nobody reads the words cynically, Othello's "You're welcome, sir, to Cyprus" is Heaven-sent copy for the appropriate authorities in their drive to attract visitors to the island. Equally apt, on October 31st (having regard to temperatures then obtaining in England and Cyprus), was Richard of Gloster's "Now is the winter of our discontent made glorious summer by this sun of York." The words were delivered by Sir Alfred Le Maitre (Controller of Ground Services, Ministry of Transport and Civil Aviation), at a dinner in Nicosia marking the inauguration of Skyways' "Crusader" colonial coach service between the United Kingdom and Cyprus, using, of course, Avro Yorks.

The first public flight was scheduled for last Wednesday, November 11th, and the service will henceforth operate on alternate Wednesdays from Skyways' Stansted (Essex) base and on Thursdays from Nicosia, Cyprus. Single and return fares are £41 10s and £75 respectively, and Skyways take some pride in the fact that the return fare is £33 less than by any other air service to Cyprus. The island being in the sterling area, the company believes that it will be possible to enjoy a fortnight's holiday, with luxury hotel amenities, for about £100. The same service, incidentally, forms the first direct air link between the islands of Malta and Cyprus, the corresponding single fare being £18 10s and return £33 8s. "Crusader" Yorks will carry freight at normal I.A.T.A. United Kingdom/Nicosia rates, and a special rate of 2s 9d per kilo (3s 8d per kilo under 45 kilos) between Malta and Nicosia has been agreed.

Passengers with Sir Alfred Le Maitre on the inaugural flight included Mr. R. E. Hardingham, Secretary and Chief Executive of the Air Registration Board; Sir Wavell Wakefield, director of Skyways; A. Cdre. Sydney Smith, the company's contract manager and Mr. H. P. Snelling, commercial manager. Pressmen, travel agents and others with direct or indirect claims to participation, brought the passenger list to 32, when York G-AHEY, with Skyways' chief pilot, Capt. A. N. Marshall, in charge, left the bleak purlieus of Stansted Airport below and spiralled for height before heading south across the airways.

At Malta drinks and a meal were stoked atop the nourishment bountifully offered aboard the York, and six more passengers joined though the load was still short of the advertised 45.

A flight bulletin gave notice that Crete lay near in the Stygian blackness, and A. Cdre. Sydney Smith recalled how many a long year ago he had taken Sir John Salmond into that island's Mirabella Bay in a Blackburn Iris.

The excursionists booked in at Nicosia's Ledra Palace Hotel in the early hours of the morning after that of departure, exhibiting various symptoms of weariness and deafness—but of contentment too. No one would pretend that fourteen or so hours out of twenty-four are most agreeably passed in a York; but neither can it be denied that a fortnight in Cyprus for £100 or so is a very attractive reward indeed.

Mr. Eric Rylands, Skyways' managing director, had been in the Middle East on business and joined the party on the first day in Cyprus. At the inaugural dinner he expressed sympathy with the people of Cyprus over the recent tragic earthquake. He reminded guests that his company had been operating through and from Cyprus since the war, and that in recent months it had carried large numbers of Her Majesty's Forces from Britain and the Canal Zone for service or holidays. Military installations in Cyprus, he said, were increasing. Though the Crusader service would initially run only once a fortnight, he hoped and believed that the licensing authorities in the United Kingdom and Cyprus might be persuaded to permit greater frequency. He disclosed that Skyways had carried over 70,000 passengers and had flown nearly 150 million miles last year "to this end of the Mediterranean."

The Governor of Cyprus (His Excellency Sir Andrew Wright, K.C.M.G., C.B.E., M.C.) being occupied with pressing tasks connected with earthquake relief, he was represented by the Colonial Secretary, Mr. J. Fletcher-Cooke, C.M.G., who remarked that, as the island had no internal air services, and as the Naval helicopters had been withdrawn, it took a considerable time to reach the remote villages on the western end of the island.

Better content was Colonel R. Strickland, who replied for Malta, and who observed that, whereas the fastest service between that island and Cyprus had previously taken three days, there was now a link of only five hours.

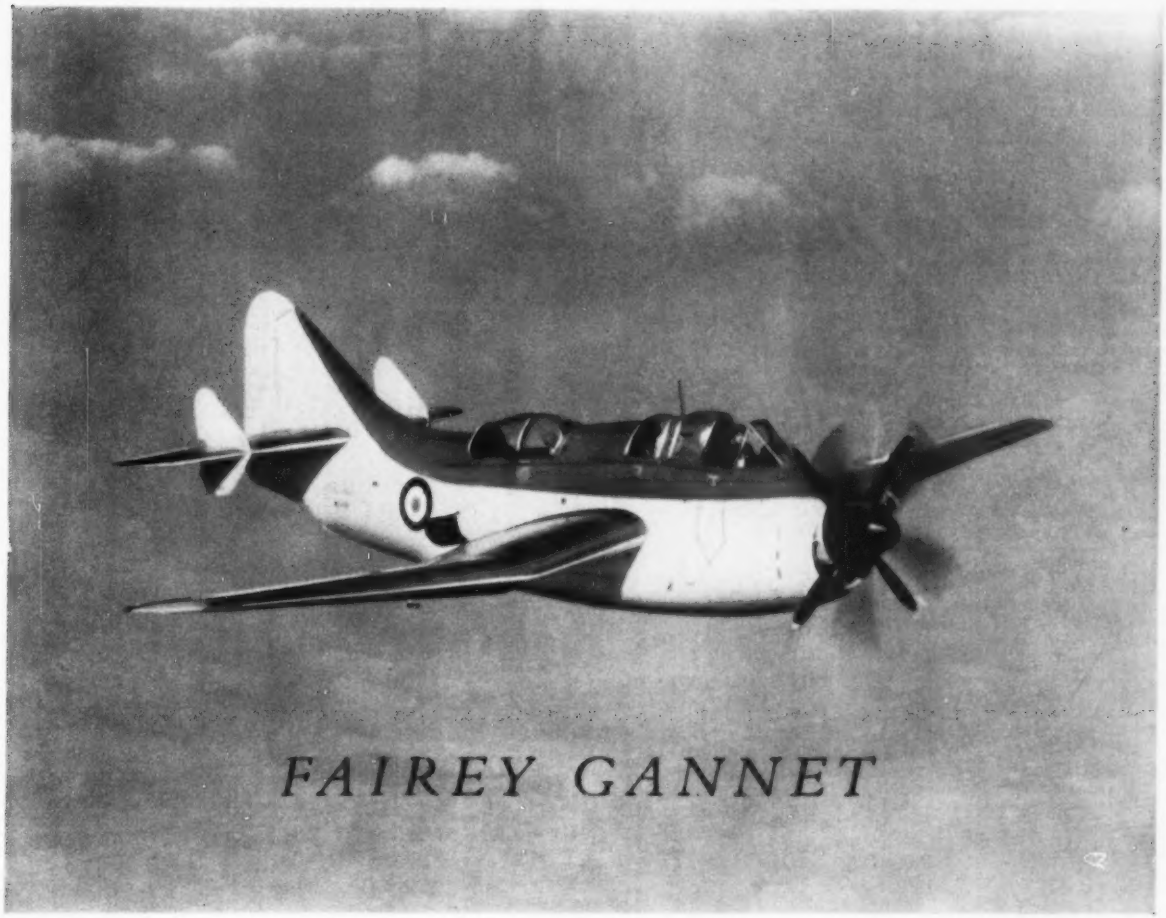
The writer took the opportunity of learning something about the air affairs of Cyprus from Mr. D. R. Forsdyke, Director of Civil Aviation to the Cyprus Government. Nicosia, said Mr. Forsdyke, was a joint-user (R.A.F./Cyprus Government) airfield. Hitherto the Government had contracted the management of the civil section to Cyprus Airways, and civil signals had been the responsibility of Cable and Wireless, Ltd. From January 1st next the Government would itself run the civil terminal area with its own staff and would take over civil signals, leaving Cable and Wireless to operate the transmitter station at Saranta Spelia. The arrangement with the R.A.F. whereby that Service was responsible for air traffic control, meteorology, fire-fighting, etc., would continue, the Cyprus Government making an appropriate contribution to Air Ministry funds.

Ten Lines to Nicosia

It had been planned to lengthen the main runway to 8,000ft, which would involve diverting a main road; taxi-tracks were to be widened to 75ft and the parking area increased. In this latter connection Mr. Forsdyke reminded us that Nicosia is now used by scheduled services of the following companies: B.O.A.C., B.E.A., TAE (National Greek Airlines), DHY (Devlet Hava Yollari) Turkish State Air Lines, Middle East Air Lines, Air Liban, El Al Israel Airlines, Misrair, Cyprus Airways and Skyways. The airfield work was considered by Mr. Forsdyke to be of the greatest importance, for the present runway (200ft of which was, in any case, sterilized by the road junction) was already marginal in the worst temperature conditions. We gathered, however, that, as a result of the earthquake damage, the airport improvement scheme might be seriously set back.

We ourselves were able to observe that the night-flying facilities were not up to modern civil standards. The R.A.F. in Nicosia, of course, argue that they are training pilots to fly for war and that, in any case, relatively little night-flying is needed in connection with their particular work. The civil Government, therefore, hopes to procure new equipment, including Calvert approach lighting, on its own account. The new 2½ kW M/F beacon on Mount Olympus, operated by the R.A.F., is proving of very great value to the airlines; R/T. contact at 300 miles and bearings at 200 miles are not uncommon. Shell's contribution to the island's flying facilities will be a new static refuelling installation, initially with six points.

As a footnote to the above comes news from the Air Ministry that over 13,000 Service leave-goers flew in Skyways from the Suez Canal Zone to Cyprus between April and October last year. It is further disclosed that the R.A.F. instituted a scheme for helping the company with spares for, and servicing of, their Yorks, the crews of which, operating a shuttle service with only two machines in any given period, flew between 100 and 120 hours a month to clear the reception depots.



Powered by an Armstrong-Siddeley "Double-Mamba" engine.

THE Royal Navy, which has to maintain sea communications, regards counter-measures to the submarine threat as of first importance. Much of the new anti-submarine equipment is specialised, and demands unique capabilities and characteristics from the aircraft employed. To cover this feature of defence the Fairey Gannet is in super-priority production, and has also been ordered for the Royal Australian Navy.

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COMET

The New World Airliner

Comets have already flown
22,000 hours — nearly ten million
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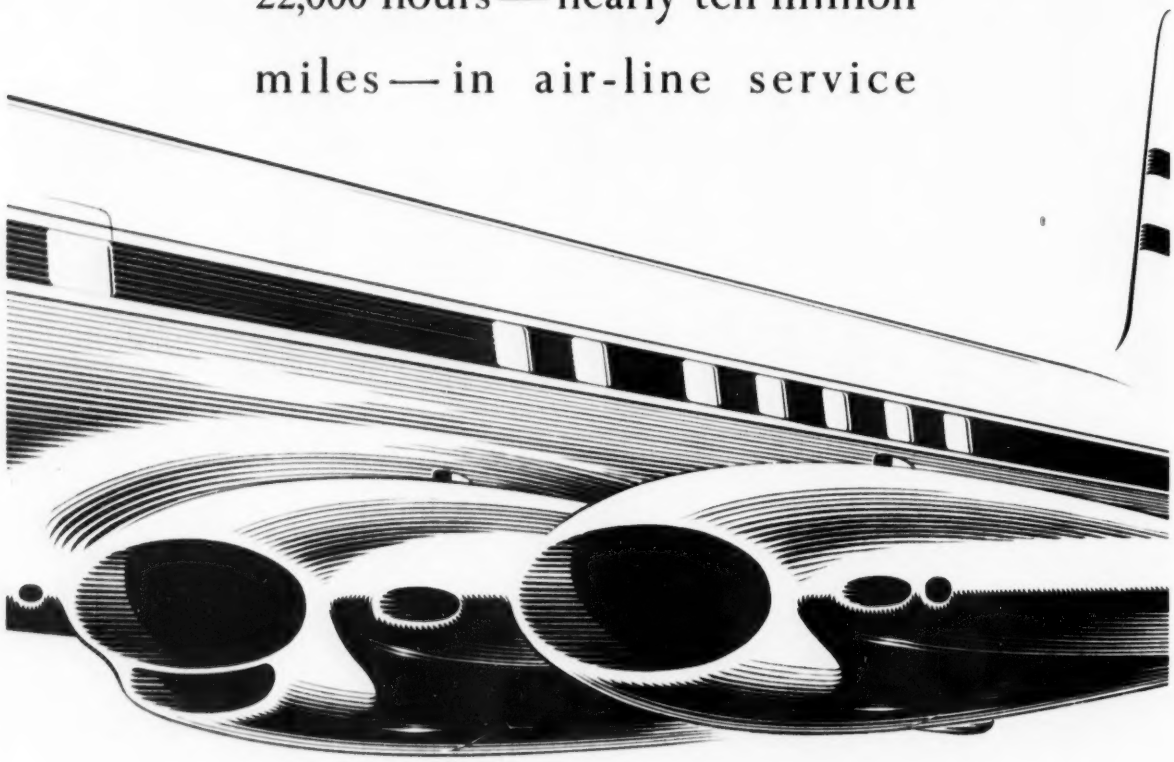


They are now flying 150,000 miles a week

DE HAVILLAND

of GREAT BRITAIN

DH ENGINES DH AIRCRAFT

AIRCRAFT INTELLIGENCE

The Douglas JD-1 and the Convair LB-30 Liberator are both basking in the sun at Nice. The Liberator is the personal transport of Emperor Bao Dai of Viet Nam; the final two letters of the registration no doubt signify the distinguished ownership of the aircraft.

Great Britain

Gloster Meteor F.8. To meet widespread criticism of the rearward field of view from standard Mk 8s the hundreds of aircraft now in service are being retrospectively modified with a new canopy which is wholly transparent. It needs quite extensive rebuilding, for the rails and sealing system are quite different; a photograph appears below.

Hawker Hurricane. At the foot of this page is a photograph of LF 363, the last Hurricane still in a serviceable condition in the Royal Air Force. Lack of spares is making LF 363 increasingly non-standard; in the photograph it is fitted with Spitfire mainwheels and an Oxford tailwheel, and we hear that other changes have been necessary inside the aircraft.

Canada

Avro Canada CF-105. Reports have been current concerning a number of unorthodox fighter designs emanating from Avro Canada including, as *Flight* readers know, persistent rumours of a "flying saucer." The latest, quoted by *Aviation Week*, concerns a delta-wing machine, designated CF-105. The project is stated to have been financed by the Canadian Government, who have "not decided when to go ahead." The Hawker Siddeley Group are not yet prepared to confirm, or deny, the report.

United States

Chase C-123B Avitruc. This twin-Double Wasp assault transport was designed by Michael Stroukoff, formerly of the Chase Aircraft company. The latter company is now owned by Kaiser Motors, with whom Stroukoff is no longer associated, and the U.S.A.F. contract for 160 C-123Bs has long been the subject of controversy. Now it is learned that the award has been made to Fairchild, who have been affected by a "stretch-out" in C-119G production at their plant at Hagerstown, Md. Production of the C-123B will begin at that plant next summer. Only one C-123B is yet flying.

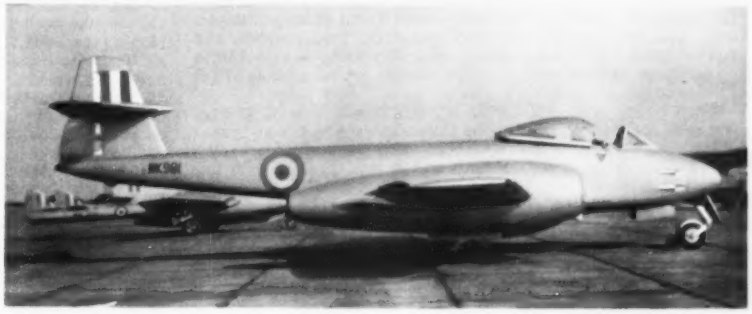
Convair XB-58. This supersonic delta-wing bomber is to be powered by four very large General Electric turbojets. The bogie landing gear will retract into the wing. Termed "Hustler" by Convair, it is one of the first aircraft to be built under a new system whereby the primary contractors (Convair, in this case) can sub-contract most of the aircraft systems to other firms of their own choice. Previously, all the armament, electronics, and similar equipment was either Government-furnished or allocated to firms by the U.S.A.F. Convair have put out development of the autopilot to Bendix-Eclipse, and the navigation equipment to Sperry. But, following failure of talks with General Electric, the armament—originally to be a G.E.C. responsibility—is likely to go either to Emerson or to Sylvania. The XB-58 prototype is to be built at Fort Worth; it will resemble a greatly-enlarged F-102.

Douglas A3D. Still unnamed, this twin turbojet carrier-based bomber is now in full production at El Segundo. The first machine off the line flew from Los Angeles International Airport to Edwards A.F.B. last month. A special variant of the U.S.A.F. version (the B-66) is to be built in large numbers at Tulsa, Oklahoma, where B-47s are now made.

Douglas JD-1. It is not widely known that a considerable number of Douglas B-26 (then A-26) Invaders was supplied to the U.S. Navy in 1944-6. Many are still in use on duties which include testing of experimental gear and missiles, calibration of radio and radar installations and development of air sea and air ground techniques. The JD-1 above has an uncommon transparent nose, behind which can be seen a centimetric radar scanner. It was photographed this summer at Nice.

Netherlands

Fokker S-14. The S-14 Machtrainer (one word, apparently) is steadily progressing, although it has no NATO backing. A batch of 20 for the R.N.A.F. is under construction and 50 others are to be built at Fokker's new Brazilian plant. The first prototype is now flying with a Nene installed and with a new Dowty undercarriage and revised air brakes. With the Nene, weight is 12,250 lb and top speed 516 m.p.h.



The Meteor F.8 is of the latest pattern, the final batches of which are now being delivered from the Gloster factory. The Hurricane was originally built as a Mk 2c, but is now a "one-off" type. Both machines are referred to above.

Twilight: the DC-3's retirement—an event not due for at least five years—is anticipated by this fine study of a B.E.A. Pionair.

Replacing the DC-3

Economic and Technical Aspects of a World-wide Problem: A North American Viewpoint

By KARL LARSSON*

WE are accustomed to thinking that an aeroplane is built for a specific purpose; the military call it "mission" and airline operators talk about a long-, medium- or short-range aircraft; or a domestic, trans-continental or overwater aircraft.

Which comes first—the aircraft or the purpose? You will say: "Of course, the purpose." It seems natural and orderly that you define first the type of traffic and operational requirements, and then design to meet these requirements. It may be so now, but in the earlier years of aviation it was rather the opposite. The DC-3 is a case in point.

When people first saw the DC-3, or a description of its performance and characteristics, the immediate reaction was that it had more of everything than its predecessors: more payload, more speed, more range, more comfort, and it was therefore a better aircraft.

It hardly occurred to anyone whether it was built for short, medium, or long range—or whether it was particularly suitable for overland or overwater flight. The DC-3 was really an all-purpose aircraft and it has been used for all purposes. Except for long over-water flights—for which the flying boat was still considered the right thing—the DC-3 began to fly everywhere in the world.

U.S. domestic operators put it on the transcontinental runs. Travel time from New York to Los Angeles was about 16 hr, 14 hr eastbound. It was a marked step forward in comfort, although the frequent stops and long flight time do not seem very impressive today. The DC-3 was also adopted by European operators; K.L.M., for example, on their 9,000-mile route to the East Indies, over jungles, deserts and sea. It became the accepted aircraft between European capitals.

By the beginning of the second world war about 350 of these aircraft had been built and delivered, and had rapidly accumulated more hours and miles flown than any other type. In fact, the DC-3 probably did more to further the development of air transportation than any other aircraft has done, before or after.

In the process, air transport began to mature, and it became apparent that a new type of aircraft was needed—one with larger capacity and longer range.

The manner in which the American industry went about this is significant. A joint committee was nominated—with Dr. Warner as chairman—for the purpose of writing a specification which could be submitted to the manufacturers. This time the purpose came first.

Work was started by Douglas, but the war intervened and brought about a great many disturbances. Development of the four-engined aircraft was speeded up and resulted in the well-known C-54, or DC-4. Other four-engined types were initiated, such as the Constellation series. The war also brought about another development which has had more of an impact on the industry than anything else—the mass production of cargo DC-3s, otherwise C-47 Skytrains or Dakotas.

Of the 10,000 built many were lost in the war, but those remaining still outnumber any other type of transport aircraft in use today. Not counting the 5-6,000 Dakotas in military use, about 1,600 commercial DC-3s are flying today. Their approximate distribution, in 1951, was as shown in the table in column 3.

Talk of "DC-3 replacements" implies that the DC-3 is in some way insufficient or unsuitable and therefore needs to be replaced. Let us examine this implication.

Being certificated in 1937, before present regulations were enforced, the DC-3 still operates [in the United States] under the old Bureau of Air Commerce Rules, Bulletin 7A, which are easier to meet than the new regulations, which would apply to any DC-3 replacement. Right there is one good reason why we don't have a DC-3 replacement.

Under the 7A Rules, the DC-3 can take 21-24 passengers, or a payload of 4,800 lb, at a cruising speed of about 175 m.p.h., a distance of up to 200 miles with prescribed fuel reserves. The DC-3 operates from a 3,500ft grass field, which is one of the key points to its usefulness in many areas of the world. Over a 12-month period, a DC-3 usually produces about 6 to 8 million seat-miles, or makes available 800,000 ton-miles.

The original price of the DC-3 was $100,000-$125,000, but most DC-3s have actually been purchased as war surplus at prices ranging from $15,000 to $50,000. Even with a modest depreciation the majority have been written off the books, which, of course, helps to lower the cost of operation. Direct operating cost in the U.S.A. is about $65.00 per hour, in Europe about 100 per cent higher.

**Abstracts from a paper before the Canadian Aircraft Technicians' Association in Montreal on October 15th. Mr. Larsson is chief sales engineer of Canadair, Ltd.*

Super DC-3: large military orders, but too expensive for the airlines.

Scandia: in limited airline service in Brazil and Scandinavia.

Area	No. of a/c.	Annual seat-miles (millions)	Annual seat-miles per a/c. (millions)
Canada-Alaska ...	62	376	6.06
U.S. Trunk lines ...	272	2,105	8.10
U.S. Local lines... ...	127	781	6.15
Central America, Hawaii	201	909	4.52
S. America	229	1,053	4.60
Europe	264	817	3.10
Middle East	55	145	2.64
Africa	69	209	3.03
Asia	171	604	3.53
Australia, Oceania ...	94	656	7.00
	1,544	7,655	4.95

As recently as 1945 less than 400 DC-3s were taking care of *all of the U.S. traffic, i.e.,* 3.8 billion seat-miles. The average stage distance was probably around 250 miles, but on the transcontinental routes DC-3s had often to span distances up to 600 miles, eventually with reduced payload.

After the war all long hauls between many cities were taken over by four-engined equipment and the DC-3 got the "left-overs," small cities and low-density traffic on short distances. Such routes are the toughest to make a go of, *regardless of the type of aircraft employed,* for two important reasons: (1) Every stop costs money. Thus operation with short hauls is more expensive per mile or seat-mile, than the long haul. The shorter the haul, the more marked the trend. (2) Load-factors are notoriously low in this type of traffic, producing a low revenue yield.

American trunk lines soon tried to minimize these detrimental effects by omitting as many of the small stations from their route system as the C.A.B. would permit. C.A.B., realizing that they could never expect to get whole-hearted co-operation in local service from the trunk lines, decided to support the many up-and-coming smaller feeder lines who were eager to accept this traffic.

The feeder lines became officially recognized as a group—the so-called "local-service airlines," working parallel with, and complementary to, the trunk lines, on a route system having an average stage distance of only 65 miles. The idea was that the local service operators, working under less exacting and elaborate standards, would be able to economize and show lower indirect costs than the trunks. Applying their interest to serve the local communities, they would possibly succeed. The whole thing was considered an experiment and C.A.B. was willing to lend support during the first period of growth, in the hope that these subsidies would later decrease and eventually disappear entirely.

This reasoning, as is apparent now, was too optimistic. As long as the trunk lines operated local service as part of their system, they could balance losses on this service against profits on the more lucrative routes. The local-service lines, deprived of any such routes, have to face the high cost of short-haul traffic, and low load factors and revenue, which make it a losing proposition. In addition, keen competition from the world's most developed surface transportation system prevents them from asking the revenue rates that would be commensurate with the high cost of short-haul operation.

The growth of traffic has therefore been accompanied by a need of increasing subsidies, contrary to the hopes that C.A.B. held out. In this situation the local-service airlines have contended that the DC-3, which was really not designed for this class of traffic, presents a handicap, and that, given the right type of aircraft, they would stand a better chance.

Local service, on the American pattern, has also been tried in Europe, but here the majority of air traffic is largely of the "inter-city" type. The Scandinavian countries have an internal route system, but it suffers from the same weaknesses as local service in the United States. Operating cost is high and competition from excellent and inexpensive rail transportation means that the passenger cannot pay the real cost, and yet the fare is so high that a broader market cannot be reached. The result is economic loss and subsidies from the Government. The same is true of the British Isles.

Holland decided to abandon internal air services several years ago. As a result, inter-city traffic in Europe is mainly flown by larger types of aircraft—such as Convair 240, Viscount and DC-6; the DC-3 is used only to fill-in.

As for the rest of the world, the DC-3 is usually operated on medium hauls overland wherever the traffic does not warrant a larger aircraft. The ability to operate from relatively small airports without runways takes on importance and is probably one of the major factors in favour of the DC-3 in these areas. It must be remembered also that in many cases air traffic has been made possible only because of the availability of the surplus DC-3, and would not have existed had it been necessary to finance new equipment and pay depreciation costs from operating revenues. This is a very important fact to remember when contemplating the design and building of a DC-3 replacement.

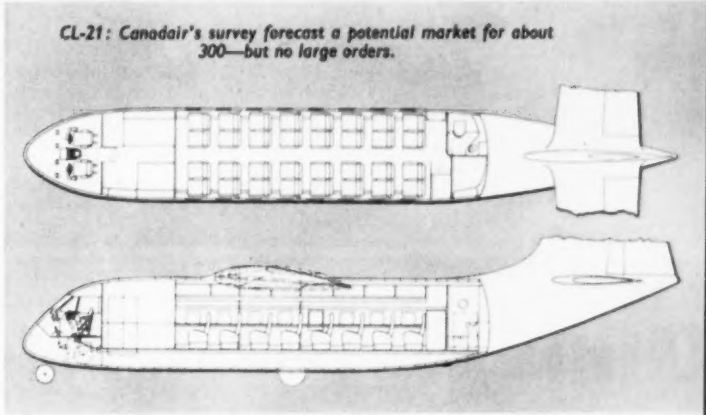
Is there a demand for DC-3 replacement? Yes, I think the answer to this question must be in the affirmative. I have already mentioned the U.S. local-service airlines, who have even come up with a set of requirements for the plane they want. Their reasoning is that the DC-3 was really not built to hop up and down every 75 miles, plus the fact that, being a twenty-year-old design, it is not as efficient, comfortable or modern as it could be.

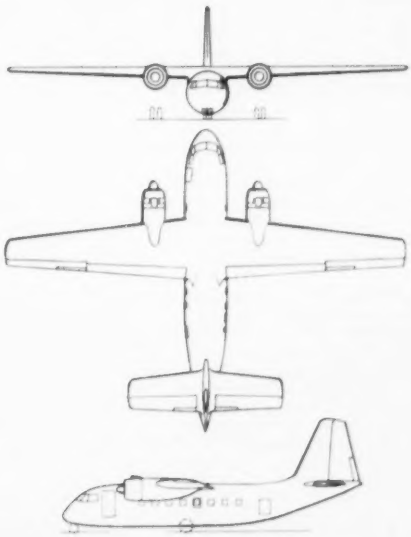
With tricycle gear, taxying and ground-handling could be speeded up, with a pressure cabin, the discomfort of frequent climbs and descent would disappear; and with higher cruising speed the time tables could be improved. All this would stimulate traffic and improve load-factors, eventually lifting local service to the crucial breakeven point.

For some of the bigger local operators a new aircraft might well mean the difference between subsidiary status and self-sufficiency, but I feel that the fundamental problem of short-haul operation still remains the *locals as a group,* and cannot be changed by a new type of aeroplane.

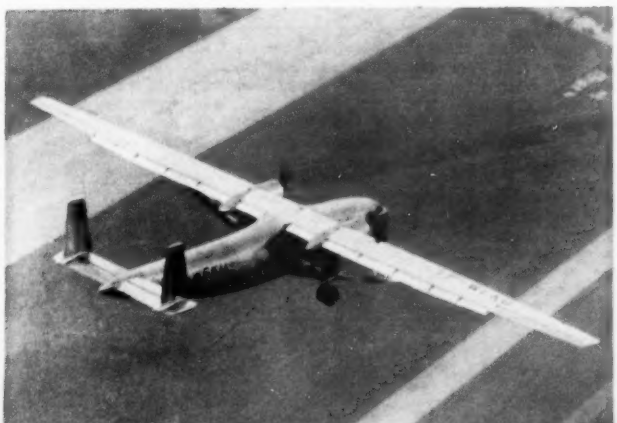
We are therefore still confronted with the problem of how best to

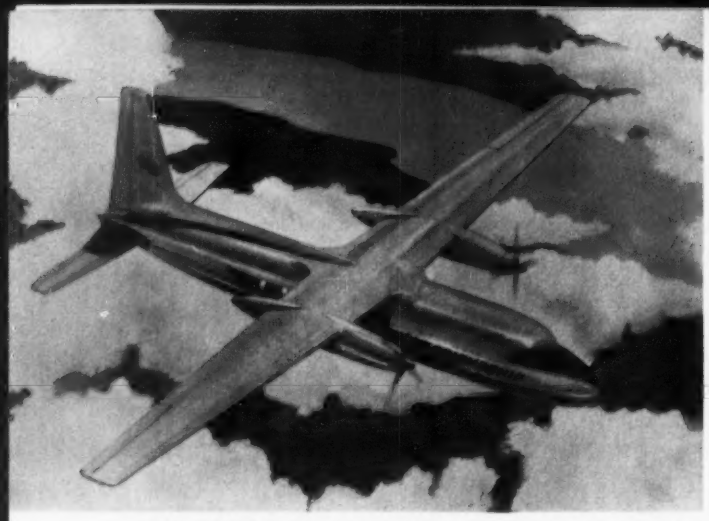
CL-21: Canadair's survey forecast a potential market for about 300—but no large orders.



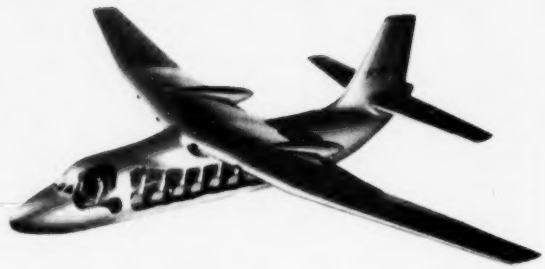


Hurel-Dubois HD-31: French prototype with high-aspect-ratio wing.





F.27 Friendship: of similar configuration to the CL-21, but employs Rolls-Royce Darts. Fokker are building two prototypes.



P.87: Percival's new project with Napier turboprops and seating for 36. Details had not reached Mr. Larsson when he presented this paper.

H.P.R.3: the only DC-3 replacement with four engines (Alvis Leonides Majors). Handley Page have completed a mock-up.

Accountant: Aviation Traders also chose two Dart turboprops.

Replacing the DC-3 . . .

transport passengers over hauls of 50-200 miles, with an average hop of 75 miles, in an economic way, and in competition with private automobiles, bus and railroad. I think that this requires a new form of vehicle—a rotary-type aircraft which can pick the passenger up and deliver him closer to the spot where he wants to go, thus short-circuiting the present ground transportation from a down-town centre to an airport. The higher operating cost of rotorcraft would be balanced out by the time and cost saving in ground transport.

We have just witnessed in the last few months the inauguration of helicopter passenger services in the New York area. One of the local-service lines—Mohawk—has announced its intention to switch to helicopter operations. National Airlines have similar plans in the Miami area.

I think these initiatives are a step in the right direction. It is a pity though that development of the rotorcraft is only in its beginning and that there will be quite a few years yet before twin-engined, 40-seater economic air coaches will be available—probably by 1959-1960.

In the rest of the world there is also a definite demand for a DC-3 replacement. Canadair did a market survey last year which showed a need for roughly 150 aircraft by 1955. Recalling that present operations outside America are generally over longer distances (200-300 miles), and that competition from surface transportation is not as keen as in the U.S., this calls for an airliner of conventional type and modern design.

In some cases—for example, Belgium and England—population density is such as to make rotorcraft service advantageous. Sabena have already inaugurated helicopter service with passengers.

The difficulty in satisfying this international market is that the needs are divided up into small lots—maybe three to seven aircraft each—and cannot be put together in one single order for 150 aircraft, a figure which would be a necessary minimum in order to embark on the manufacture of a new type of commercial aircraft.

My conclusion, therefore, is that the need for a replacement of the DC-3 is not so much because of shortcomings of the DC-3 as an aircraft, but for other reasons. In the U.S. the reasons are to be found in the characteristics of the traffic itself, route pattern, density, competition, etc. In the world at large the need is for additional capacity of a conventional but modern aeroplane, reflecting the latest advances in the state of the art.

Such an aeroplane, however, cannot be counted on to being a marked economic improvement. It will have direct operating costs equal to—perhaps five per cent better—than those of the written-off DC-3.

Have any efforts been made to build a DC-3 Replacement? Yes, but none that have been successful so far. Some of them still exist only on paper and have yet to prove their merit.

Super DC-3: Douglas, very logically basing their programme on the existing large numbers of DC-3s, proposed in 1948 the so-called Super DC-3, embodying new wings, new engines and a longer body, increased speed to about 225 m.p.h., seating capacity of 31 and payload capacity of 7,000 lbs. However, the landing gear still remained the old type and the cabin was not pressurized. These reasons, plus the fact that the conversion cost came close to $300,000, made the airlines reluctant. Only three Super-DC-3s have operated commercially, but some 200 are being delivered for military transport services.

Scandia: Saab, about the same time designed and built the Scandia, a twin-engined 32-seater airliner with tricycle gear. Unfortunately it did not have cabin pressurization and was built only on a limited scale. Scandinavia has six Scandias and four are flying in Brazil. A few more are being built on licence by Fokker.

CL-21: at one time Boeing negotiated with Saab to build a pressurized Scandia on licence, but the deal was never consummated. It was for this reason that, in 1952, Canadair undertook to study the possibilities of building a DC-3 replacement.

With the local-service airlines in the U.S. urging very strongly at the time for a new aircraft to meet their requirements, we naturally used their specification as a basis. The result has been presented to the airlines as the Canadair 21, a twin-engined, high-wing, 32-seater with tricycle gear and pressure cabin. Compared with the DC-3, the CL-21 offers 50 m.p.h. more cruise speed, 50 per cent higher payload and seat capacity, plus all the design improvements, at five per cent lower direct operating cost per seat-mile. We made the market survey on the basis of an assumed selling price of $450,000, and we think that about 300 could have been sold at this price by 1955-1957. However, after completing the design specification and going over the cost again, we found ourselves unable to produce it at the price mentioned—it would have to cost about $530,000. Since the CL-21 would be a privately financed undertaking, without Government support of any kind, we would require assurance from the airlines of a substantial order before we could possibly embark on the project. Anything else would be sheer suicide. The only group from which such a concerted effort could come, would be the U.S. local-service lines, who—living on the verge of break-even with the help of subsidies—are not financially strong enough to foot the bill on their own. The international market, which is about the same for an equal number of aircraft (i.e., 150), is split up into perhaps thirty different airlines, each waiting for the other to take the first step.

Friendship: The Fokker F.27, or Friendship, is a turboprop powered, high-wing, 28-seater, with Rolls-Royce Dart engines; two prototypes are now being designed and built. This machine has very similar characteristics to the CL-21 and what has been

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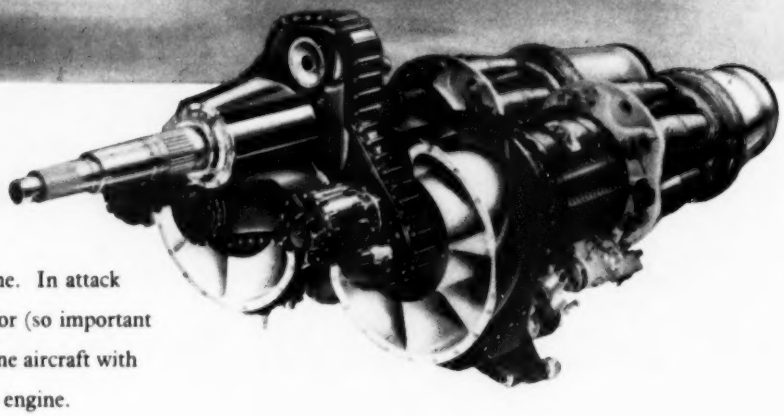
A convoy steams on, unmolested by enemy submarines. A Fairey Gannet returns to its parent carrier, from a long patrol—striking and killing enemy submarines before they can make contact with the convoy.



The great radius of action of the Gannet is made possible by its low fuel consumption patrolling on one half of its Armstrong Siddeley Double Mamba turboprop engine. In attack the second engine is cut in, providing the safety factor (so important for marine operation) and performance of a twin engine aircraft with the fuel economy and stowing advantages of a single engine.

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Replacing the DC-3 . . .

said about the market can also be said for the F.27. The Dart engines make this aircraft a little more interesting from a technical standpoint, but on the other hand it does not get down to the rock-bottom seat-mile cost of the CL-21.

H.P.R.3: Another proposal of interest is the Handley Page H.P.R.3, which is a four-engine, high-wing 36-seater, with tricycle gear and pressure cabin. It is almost a CL-21 with four engines. For those of us who are accustomed to thinking of four engines only in connection with large, long-range aircraft, it may be of interest to mention a few words about the reasons for four engines.

I have been assured that there are places where weather conditions and terrain make a twin-engined aircraft unsatisfactory, at least for night flying. The downpour in torrential storms, coupled with high terrain, lack of emergency airports and very limited navigation facilities, are said to make a four-engined type almost mandatory.

Now this may be true, but I feel it is rather the exception than the rule, and as far as we in Canadair are concerned at least, we think that for a DC-3 replacement, aircraft simplicity and ease of maintenance of a twin-engined aircraft are essential.

Furthermore, it follows from the airworthiness requirements in one-engine-out case, that the twin-engined aircraft operating on both engines—which, after all, it does 99 per cent of the time—has 100 per cent surplus power, whereas the four-engined one has only 33 per cent.

H.D.32: The aspect ratio of this Hurel-Dubois design is somewhere around 20. I have learned that a high aspect ratio is a very desirable thing to have when you want to beat the world record for long range, but that otherwise one is usually quite happy with an aspect ratio of around 10. Higher aspect ratios mean less c.g. travel and are not very practical from this viewpoint. Furthermore, one usually wants to avoid the structural problems involved in a large span, thin, flexible wing. The latest news is that Air France are ready to order 15-20 of these things. Well, all I can say is that if M. Hurel-Dubois and Air France prove to be right, an awful lot of us must be wrong.

Accountant: Aviation Traders' bid for a DC-3 replacement is a very recent development. It has two Rolls-Royce Dart engines like the Fokker F.27, but it is a smaller aircraft, seating something like 24 passengers [the makers state that it is designed to carry up to 33] and it has higher performance than the Fokker or the CL-21. How the direct operating cost compares we have not had time to find out, but, logically, the cost per seat-mile would be higher in inverse proportion to the number of seats. The selling price of $225,000 sounds attractive.

The picture would, of course, change entirely should Government or military sponsorship become available. For example, if Canadair received an order for 75 military cargo CL-21s to break the ice, it would be a matter of course to run off a couple of hundred more for commercial purposes—which would be quite reasonable in price at the tail end of the production line. Therein, perhaps, lies the only solution to the DC-3 replacement problem.

THE STORMY LIFE OF ERNST HEINKEL

THE words "sound barrier" fall today lightly from the lips of the least knowledgeable, and the term "heat barrier" is even now being darkly uttered. The aircraft to which these terms apply grow fatter, stiffer and heavier, and the way to the planets begins to unfold before us. But it is all too easy to forget those men who, in the early years of flying, made those first courageous steps on the road to sonic flight—the all-metal structure, the retractable undercarriage, the 1,000 km/hr speed record and the first rocket- and jet-propelled flights. These barriers were just as great and as exciting to break down as was the sound barrier to the men of the post-war years.

Isolated names and achievements stand out: men who made a few steps, however spectacular, but went no farther. There were those, however, who made aviation their life's work, who made it pay commercially, so that they were able to continue developing their ideas and to set their mark, not on one or two years, but on the whole span of aviation's history to date. One such man was Antony Fokker. Another was Ernst Heinkel; and we are fortunate to have now an authoritative biography of his life entitled *Stürmisches Leben** ("A Stormy Life").

Heinkel, like Fokker, became interested in flying in its early, individualist days. When aviation was still a paying private venture, he became one of the leaders of the aircraft industry in Germany and, indeed, throughout the world; but in his position as an industrialist he never lost sight of the need and the opportunities for pioneering new designs. Whether in commercial or military aviation or research, he always strove for higher speed, better performance and superiority over rival designs, and he kept the team of designers he gathered round him as constantly at work as he did his commercial representatives with Lufthansa and the German Air Ministry.

One of Dr. Heinkel's most prominent qualities was his forcefulness. He always saw farther ahead than his clients, fought for greater progress and expended his seemingly limitless energy in order to complete his contracts and produce more and better aircraft. His energy in matters commercial was always matched by his insight into future requirements and developments in aviation. Thus, as soon as news reached Europe of the then-revolutionary transport, the Lockheed Orion, in 1931, Heinkel began work on an aircraft which would out-perform it. His design was for those days so advanced that Lufthansa, to whom it was offered, timorously ordered an interim design, the He69. Then the Orion appeared in Europe, in service with Swissair, and caused a major panic. Within a matter of days Heinkel had arranged to design and fly his originally proposed design in the same time and at the same cost as for the already part-developed He69. The result was the He70, a low-wing monoplane, single-engined, whose main and tailwheels retracted and were covered by fairing panels. In this, as in many other Heinkel types, the Gunter twins, Siegfried and Walter, were responsible for translating Heinkel's ideas into fact.

The He70 reached the then-remarkable speed of 360 km/hr (223 m.p.h.), 46 km/hr more than Heinkel had guaranteed, and this with a water-cooled engine of only 600 h.p. This performance was achieved by such expedients as flush-riveting, polished skin, curved wing tips, retractable tailwheel and carefully designed wing roots, which were still new features at the time. Heinkel tells how, having no experience of retractable undercarriages to help them in their work, his designers arranged for an engineer to hang in the wheel bay and watch the behaviour of the new undercarriage during taxying trials. He tells also of the wild delight at the successful first flight on December 1st, 1932, the tenth anniversary of the founding of the Heinkel aircraft company.

"Flight" photograph

Dr. Ernst Heinkel with his son at last year's Farnborough display.

The rise to power of the Nazis meant the resurrection of the Luftwaffe; the re-opening of the profitable field of military aircraft design on the one hand, and a steady increase in ministerial interference on the other. On May 4th, 1936, a vast new factory for the construction of He111s was begun at Oranienburg. Exactly one year later, on May 4th, 1937, the first He111 bomber rolled out of the assembly hall for test flights; such was the commercial and design potential of Heinkels, and indeed of many other German companies, during those tremendous years of resurgence.

Amidst the nationwide enthusiasm of the heyday of Nazism, Heinkel designed, produced and sold aircraft and steadily built up his industrial empire. But those undercurrents of personal strife and jealousy, of indecision and wrong decision which were a foundation for the downfall of Nazism were already stirring. Heinkel tells of the unceasing struggles even in those early days to get the right aircraft ordered from the right firms, and to overcome ignorance and near-sightedness in high quarters. In the pre-war years and even more so during the vital mid-war period, Heinkel was in a position to see and to suffer from (luckily

*"*Stürmisches Leben," by Jürgen Thorwald; published by Mundus Verlag, Stuttgart, Reinburgstrasse 95. Price DM 19.80.*

THE STORMY LIFE OF ERNST HEINKEL . . .

for us) the extraordinary vagaries of policy and the senseless decisions which continually frustrated his efforts to introduce rocket- and jet-propelled, day and night fighters. Under increasing pressure of directives and controls he came finally, like so many others, to realize that there was no longer any hope of stemming the flood of the Allied onslaught.

Yet during the years which led up to the war, and during the war itself, in the utmost secrecy, Heinkel was engaged on the design and development of rocket and turbojet propulsion. When he first saw the spectacular but dangerous performance of Opel's rocket-propelled car, he decided that here was the means of propulsion for really high-speed flight. Even while Udet was straining the He100 to gain the 100 km closed circuit record for Germany, Heinkel was supervising the installation of Werner von Braun's rocket engine in the tail of an He112 fuselage. In March, 1937, the He112, with a rocket in the tail, made its first flight. The pilot could only start the rocket and then hope for the best, with the promise of an uncertain 30 seconds' uncontrolled thrust, probably culminating in a violent explosion. On the first flight the pilot was in fact blown out of his aircraft. During a second trial four weeks later, the aircraft gained 100 km/hr in speed in a few seconds, the cockpit filled with fumes, and the pilot jettisoned his canopy in order to bale out when the machine made a fortunately gentle belly landing. But the motor was improved and the rocket-assisted He112 eventually flew successfully on the power of the rocket alone.

An obvious subsidiary development of rocket power was for take-off boost. An He111, loaded to 13 tons, successfully took off and climbed at an alarming angle, boosted by a Walter rocket "power-egg" under each wing. Then came the design and testing of the first pure rocket aircraft, the He176. This remarkable little aircraft, built in 1938, had a wing span of four metres (13ft 6in), wing area of five square metres (54 sq ft), and a symmetrical aerofoil; and it was tailored to fit the test pilot, who was 6ft 1in tall. The maximum diameter of the fuselage was 28in, as was also the track of the undercarriage. Completely new flight instruments were developed, and the pilot could eject himself from the aircraft with compressed air.

Taxi trials were carried out at the new rocket research station at Peenemünde: the He176 was towed along the beach between Usedom and Swinemünde at 96 m.p.h. by Heinkel's 7.6 litre Mercedes. But, because the Mercedes sank repeatedly into the sand, taxi trials were continued with short bursts of rocket power. Finally, in June 1939, the He176 made its first flight. On June 20th, it was demonstrated before Heinkel and Udet, and on July 3rd Hitler and Goering saw it fly. From then on, the He176 was doomed. Repeatedly, and despite constant protest, Heinkel was forbidden to continue development. Secretly he arranged an attempt to raise the world speed record beyond 1,000 km/hr, but the outbreak of war put a final end to the project. The He176 was placed in the air museum in Berlin and eventually destroyed by bombing. When the need for rocket fighters was at last realized, Lippisch and Messerschmitt were ordered to carry out development; no notice whatsoever was taken of the extensive work already done by Heinkel.

The history of Heinkel's work in jet propulsion is little different. In March 1936, a young engineer from Göttingen University, Pabst von Ohain, came to Heinkel with plans for a centrifugal jet engine. Heinkel set him to work in a secret section of the Heinkel works at Marienehe. It was thought that 50,000 marks and a few months would suffice to complete the engine, but not until September 1937, did Heinkel hear for the first time, over the long-distance telephone, the "remarkable howling and whistling noise which shook the whole building" as the engine first ran.

This engine, the HeS3, burning petrol, with rudimentary throttle controls and with a thrust of approximately 500 kg (1,100 lb) was developed for flight testing in the first pure-jet aircraft, the Heinkel He178. By July 1939, two HeS3B engines had been built and bench-tested, and one of them air-tested, mounted under the fuselage of the He118. The other was installed in the He178. This aircraft, a shoulder-wing monoplane of 26ft 8in wing span, had the engine mounted behind the pilot, with a nose intake and tail efflux. The undercarriage retracted into the fuselage. In the secretive stillness of the early morning of August 27th, 1939, the He178 made its first flight. A bird was sucked in on take-off, the undercarriage stuck down, and the pilot, finding himself overshooting after cutting the engine for a dead-stick landing, managed another quick circuit and stopped the aircraft barely short of the airfield boundary.

Heinkel now made frantic efforts to bring the great new development to the notice of the authorities, but he did not know that they were pre-occupied with other events. Then, in the tremendous tension of August 31st, 1939, Heinkel finally tackled his great friend Udet. But Udet was depressed and secretive, and finally relieved his nervous tension with a fantastic pistol-shooting episode in his drawing room. Heinkel in his turn, to calm his nerves, turned on the wireless. At that moment, the beginning of the Polish campaign was announced.

From then on, all combat aircraft designs were frozen and no amount of effort on Heinkel's part could interest the authorities in jet propulsion. Nobody, in fact, took it seriously. It was not until early in 1942, at a major aircraft-design conference that the need for jet aircraft was first stated. By that time Heinkel had produced the He280 with two turbojets and nosewheel undercarriage, but when a jet fighter was adopted it was the Messerschmitt 262. Again, features which Heinkel had already developed, such as the nosewheel undercarriage, were freshly designed and incorporated in the Me262 without reference to the work already done by Heinkel.

That twelve months' delay was caused by the attempted development of the Me262 as a light bomber is already well-known, and by the time such aircraft as this and the He162 Volksjäger were going into large-scale production the factories were being incessantly bombed; and the war was in any case virtually lost.

Such is the story which is told in Heinkel's biography. Written in the first person, it describes the 45 years in the development of Dr. Heinkel, his aircraft, his factories and the momentous times in which his most valuable work was carried out. The book constitutes, from one point of view, a history of those 45 years, the like of which will never be seen again. Dr. Heinkel himself is still in West Germany, and is ready, no doubt, to produce a further series of aircraft designs when his nation is once more allowed to indulge in such activities. C.M.L.

THREE MORE FOR THE BOOKSHELF

"Sound Barrier," by Neville Duke and Edward Lanchbery. Cassell and Co., 37/38 St. Andrew's Hill, London, E.C.4. Illustrated. Price 8s. 6d.

IN writing *Sound Barrier*—perhaps more appropriately defined by its subsidiary title, *The Story of High Speed Flight*—S/L. Neville Duke and Mr. Edward Lanchbery have tackled a particularly awkward problem. They have set out to explain to the average non-professional enthusiast the characteristics, problems and history of high-speed flight development. Starting at the point in aerodynamic knowledge which the average private pilot, for example, can be expected to have reached, they have produced in the short span of 117 pages a highly informative treatise on both the technical and the historical aspects of high-speed flight. The reader is led carefully and concisely through the perplexing maze of aerodynamic formulae and terminology and is never in danger of being "blinded by science." He emerges at page 117 with an understanding of the whys and wherefores of the weird shapes nowadays emerging from the aircraft factories of the world; he also has official chapter and verse on the historical development of these shapes and of the research achievements which led up to them.

It is the balanced interweaving of theory and practice throughout the book which makes it at once a valuable and an interesting work of reference. *Sound Barrier* offers the layman an up-to-date, authoritative introduction to high-speed flight, and a basis of knowledge upon which he may more clearly assess future developments.

"How to Fly," by Laurence C. Bagley. Blackie and Son, Ltd., 16-18, William IV Street, London, W.C.2. Illustrated. Price 7s. 6d.

THE aim of this book is, like that of many others with similar titles, not so much the instruction of budding pilots as to make sure that all who read the book will *want* to fly. It is, in fact, an engaging little narrative, perhaps aimed principally at the younger generation; it begins with a straightforward introduction to the mysteries of aircraft and eventually leads to a series of hypothetical trips with the author in a Vampire Trainer.

We feel that in its task of creating interest this modest-sized volume succeeds better than any other book of its type we have seen. In this it is helped by the fact that Mr. Bagley is up to date, knows his subject, writes in a breezy manner and—above all—has illustrated his book with his own excellent drawings in black and white and colour. *How to Fly* would make a first-rate Christmas present. There is one slip—the Gloster E.28/39 first flew at Cranwell, not Cranfield.

"The Flying Omnibus," edited by Paul Jensen. Cassell and Co., Ltd., 37/38 St. Andrew's Hill, London, E.C.4. Illustrated. Price 15s.

THIS book has nothing to do with Bea-line helicopter air buses or the car ferry. "Omnibus" is used in the sense of a collection of short stories, ranging in this case from a description of the death of Richthofen to the fantastic exploits of Sam Small from

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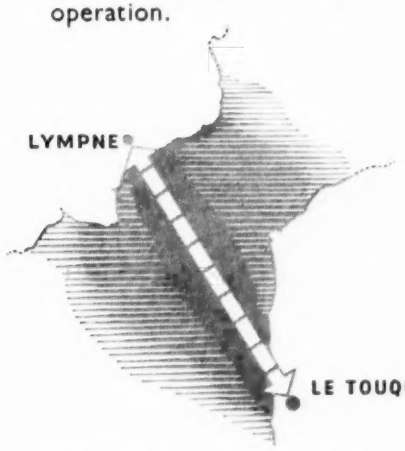

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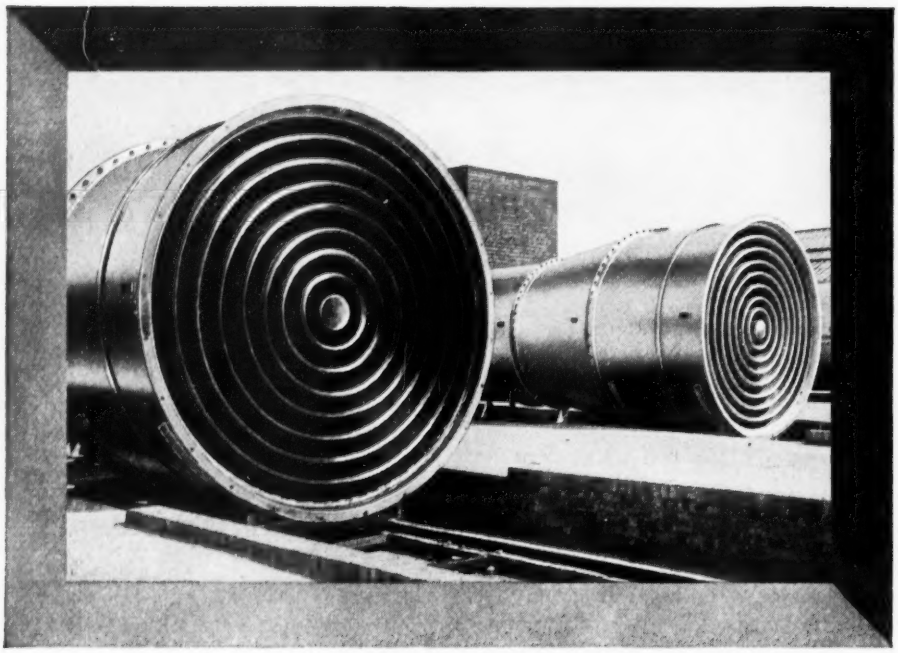

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THREE MORE FOR THE BOOKSHELF

Huddersfield, who found that he could fly with no assistance other than simple faith.

There are 30 stories in all, divided into five sections, covering respectively the period up to the First World War; then war itself; the next 20 years, when aviation grew from a carnival novelty to a vast industry; the Second World War; and finally, essays and stories which have no chronological setting.

The selection is wide, interesting and, at times, surprising. Most surprising of all, perhaps, is the first story—a lengthy and rather boring description of a fictitious transatlantic balloon flight submitted to the *New York Sun* in 1844 by Edgar Allan Poe, who was desperately short of money at the time. Many great names follow, including H. G. Wells, Ernst Udet, Francis Chichester, Antoine de Saint-Exupéry, Anne Morrow Lindbergh, Pierre Clostermann and H. E. Bates. Some of their stories are gems of aviation literature; others recall the greatest people and the greatest days in aviation's history.

It is, above all, a book to satisfy almost every mood, a book to pick up whether one has ten minutes or an hour to spare. If you have never read Guy Gilpatric's *The Genial Check-Capped Ghosts*, it is worth buying for that alone. And if you doubt that anyone can capture the whole wonder and beauty of flight in little more than a hundred words, read *High Flight* by John Gillespie Magee, an American who was killed in action serving with the R.C.A.F. in England in 1941, when he was nineteen.

PROSPECTS FOR SMALL TURBINES

Air and Surface Applications Reviewed in a Lecture to the R.Ae.S. Brough Branch

THE following is a condensed summary of a lecture which was read before the Brough branch of the R.Ae.S. on November 4th. The author was Mr. F. R. Bell, chief designer (engines) to Blackburn and General Aircraft, Ltd. In an earlier capacity, he designed the gas turbine for the Rover car, and he has made notable contributions to our associated journal "The Autocar."

IT was proposed (said the lecturer) to give a very broad picture of the present, and possible future, position of the small gas turbine in all fields. In doing so a number of controversial statements might be made, but it was to be remembered that small gas turbines were very much in their infancy, and the lecture was to be regarded more as an expression of opinion rather than a statement of absolute fact. The lecturer did, however, point out the considerable volume of practical knowledge which had been amassed both by his own company and by the French firm of Turboméca whose engines were now being produced by Blackburn and General Aircraft.

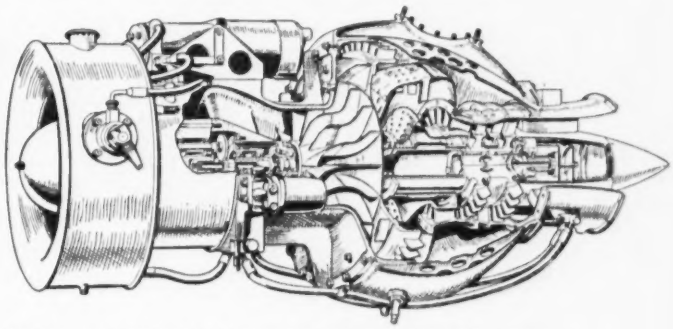
The lecturer considered one of the biggest difficulties in trying to prophesy future development was the virtual impossibility of making an accurate estimate of the time which would be taken to overcome development problems and produce a useful engine. Another trouble was, of course, lack of finance. In America, quite large amounts were being paid out by the Services and this had the effect of accelerating American progress, so that they would probably overtake us in gas-turbine development.

One of the difficulties facing the designer was the fact that a choice had to be made between a great variety of components and between various engine layouts. As an example of a simple jet engine the Turboméca Palas was illustrated (which, like all Turboméca units, employs a single centrifugal compressor, a novel annular combustion chamber and a single-stage turbine). Free-turbine and single-shaft engines were then discussed, after which the air-bleed engine was considered. The latter type, of which the Turboméca Palouste is a good example (illustrated above), employs an oversize compressor and delivers a compressed-air flow which can then be used to drive a helicopter rotor or power turbine mounted elsewhere.

Other developments covered by Mr. Bell included heat exchangers, radial-flow turbines (which resemble a centrifugal compressor driven in reverse), two-stage centrifugal compression and axial compressors. It was unlikely that there would be much future for the axial in sizes below 1,000 h.p. except for aircraft work, in which the lecturer thought the axial would be universally adopted for all powers.

One of the fundamental difficulties of developing a small gas turbine was the very great accuracy required throughout the engine, particularly in the rotating parts. On the other hand small components could be readily machined to much finer limits than could parts of a large engine, and the increased rigidity of the engine as a whole was a favourable factor in the maintenance of small clearances. Reynolds Number difficulties could also be met, although, in practice, the effect was fairly small down to a particular value. Below this figure the efficiency of the engine began to fall off readily and it appeared that 30-50 h.p. was likely to become the lower limit for efficient gas turbines.

As regards aircraft applications, this country was lagging behind both America and France in spite of the fact that some very attractive aircraft could be designed around small gas turbines. Several different types of engine could be used, but it appeared that the turboprop would be the most popular in the initial stages. For short-distance flying, aircraft using engines such as the Turboméca Marcadau (illustrated on page 652) appeared quite attractive and considerably more efficient than a jet aircraft of the same size. The fighting Services, however, had immediate applications for small jet aircraft both in the target and training rôles.

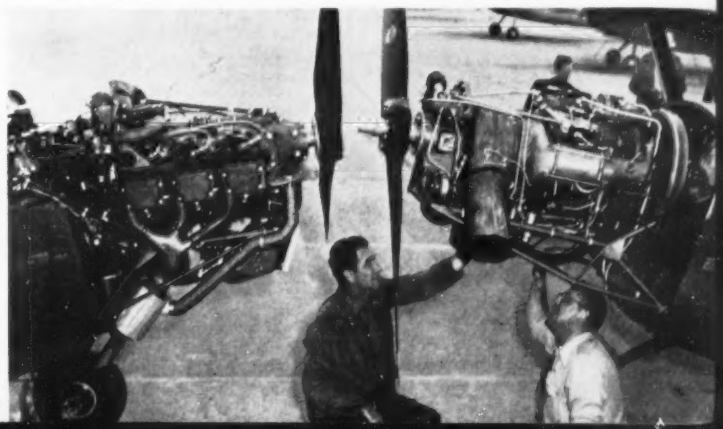


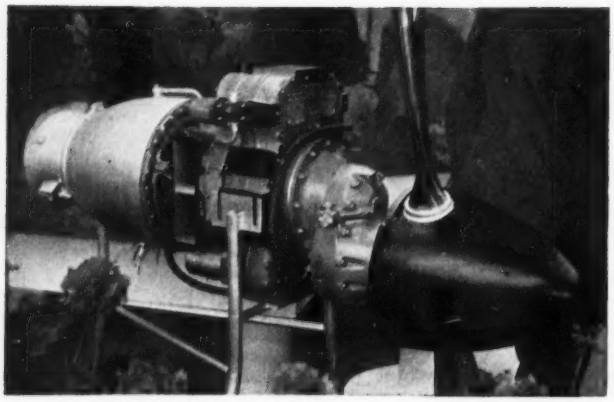
Blackburn and General hold licences to build a number of Turboméca units, including the Palouste shown here in section. The oversize compressor delivers more air than is necessary for combustion, the excess being bled off at the top of the engine and used for such purposes as supplying rotor tip jets.

A type of power plant which was likely to have applications in the future was the ducted fan or by-pass engine of which the Turboméca Aspin was an example. Between speeds of 300-400 m.p.h. it was a very efficient type of unit, although even this speed was rather high for civilian use and would require the development of specialized aircraft.

A field which in future should become progressively larger, and in which the small gas turbine might have much to recommend it, was the helicopter. Over the short stages normally flown by helicopters the light weight of the gas turbine was a big advantage and its high fuel consumption relatively unimportant as it was running for only a short time. It was almost certain that, when suitable turbines were developed, helicopters would be almost all turbine-powered. Several different types of drive might be used. It had once been thought that jets mounted on the rotor tips and fed through hollow rotor blades by a turbojet mounted in the fuselage offered a light and simple solution. In practice, the large size of the ducting through the blades and the associated heat loss made the layout appear less attractive. The next step was to feed cold air bled from the engine compressor to combustion chambers at the rotor tips,

Last year the Cessna company converted a production L-19A Bird Dog liaison aircraft to take a 200-h.p. Boeing T50 turboprop. This installation may be compared with the normal flat-six piston engine on the left.





The Turbomeca Marcadau is a 400 h.p. unit consisting basically of an Artouste with an additional gearbox at the front. Air enters on each side of the engine, which weighs 400 lb.

PROSPECTS FOR SMALL TURBINES...

but even this involved considerable losses and required thick rotor blades.

Both the above methods were also rather noisy, although nothing like so offensive in this respect as the rotor driven by tip-mounted ramjets. It appeared that, for the immediate future, the normal direct gear drive from the fuselage-mounted turbine was the best layout, particularly in the smaller sizes.

As small aircraft were usually employed over short ranges the engine would not be able to fly at anything like economical height —probably not above 10,000ft. To this degree, the small gas turbine would always be handicapped in comparison with larger and higher-flying engines but should still be able to compete with other power units.

The lecturer went on to discuss the use of gas turbines in the fixed industrial field and for powering all types of road vehicles and ships. He concluded his lecture with a review of future developments.

Among the latter were the great gains that were likely to accrue from the development of turbine blade materials built to withstand higher temperatures. One method of attack was the use of improved metals such as molybdenum which, if suitably protected against oxygenation, gave a very great increase in permissible temperature. Another line of approach was to use ceramels, which were a mixture of ceramic and metal alloys. Thermal shock was likely to rule out ceramics by themselves.

Yet another approach to the problem was the use of blade cooling, of which the most popular method was to pass air through the blades themselves. Better arrangements appeared to be to spray water (at about 10 per cent of the fuel-flow rate) into the combustion chamber or to cool the blades by conduction into the disc, either by suitably protected copper or silver plating or by drilling the blades and filling them with copper or sodium cores.

Attention was then turned to the various types of thermodynamic cycle which offered promise and Mr. Bell closed his lecture with a brief discussion of atomic energy. Summarizing all that he had said, it appeared that the small gas turbine, while it had a big future, would become really important only in the rather distant future.

The Discussion

After Mr. Bell had concluded his lecture it was at once apparent how great was the interest he had evoked; the following are some of the aeronautically-relevant points raised by questioners: specific fuel consumption of an engine such as the Marcadau was twice that of a petrol engine and three times that of a diesel; a centrifugal blower can be made "a quarter as small" as an axial, and there appeared to be no future for axials below 400 h.p.; the penny or twopence difference in price per gallon does not justify use of low-grade fuels; new techniques would ultimately reduce the cost of rotors and blading, and the other parts of a gas turbine were already cheaper than "equivalent petrol or diesel engine components"; in three years small turbines might show an s.f.c. of "0.7" (presumably lb/hr/s.h.p.), but the necessary heat exchanger would be expensive [large aircraft turboprops are already giving below 0.48 without heat exchanging—Ed.]; titanium was attractive as a heat-exchanger material, but was expensive to buy and to work; and the essential simplicity of the turbine promised a significant economy in materials.

The whole evening—a joint meeting between R.Ae.S. Brough branch and the Hull Association of Engineers—was a great success; the lecture will be repeated at the R.Ae.S. Birmingham on December 27th and at the Derby branch on February 1st next.

AXIAL-FLOW COMPRESSOR EFFICIENCY

WHEN, in our issue of October 9th, we published—under the above main heading—a brief article by J. M. Stephenson, of Brown University, Providence, R.I., U.S.A., we expected to find some of his theories being questioned. This has, in fact, occurred, and we gladly accord space to these comments by Mr. J. C. Barr, B.Sc., of Power Jets (Research and Development) Ltd., Farnborough.

THE article on "Axial-flow Engines" in the October 9th issue of *Flight* is an excellent example of an ingenious argument based on misleading assumptions. I could quibble with the argument also; but that is a second-order matter.

The radial clearance of rotating blades within the casing is surely a percentage matter. A clearance is necessary to accommodate differential thermal expansion, vibration of the shaft, end float and other mechanical matters. However, the clearance required to cope with such factors depends generally on the size of the machine; the smaller the size the smaller the clearance required. This statement may break down in machines of "watchmaking" size, but not earlier. I would say that assumption of a minimum radial clearance of 0.015 in can be disregarded. There is no reason at all why smaller clearances cannot be used in the appropriate cases—given, of course, intelligent designing and good manufacture.

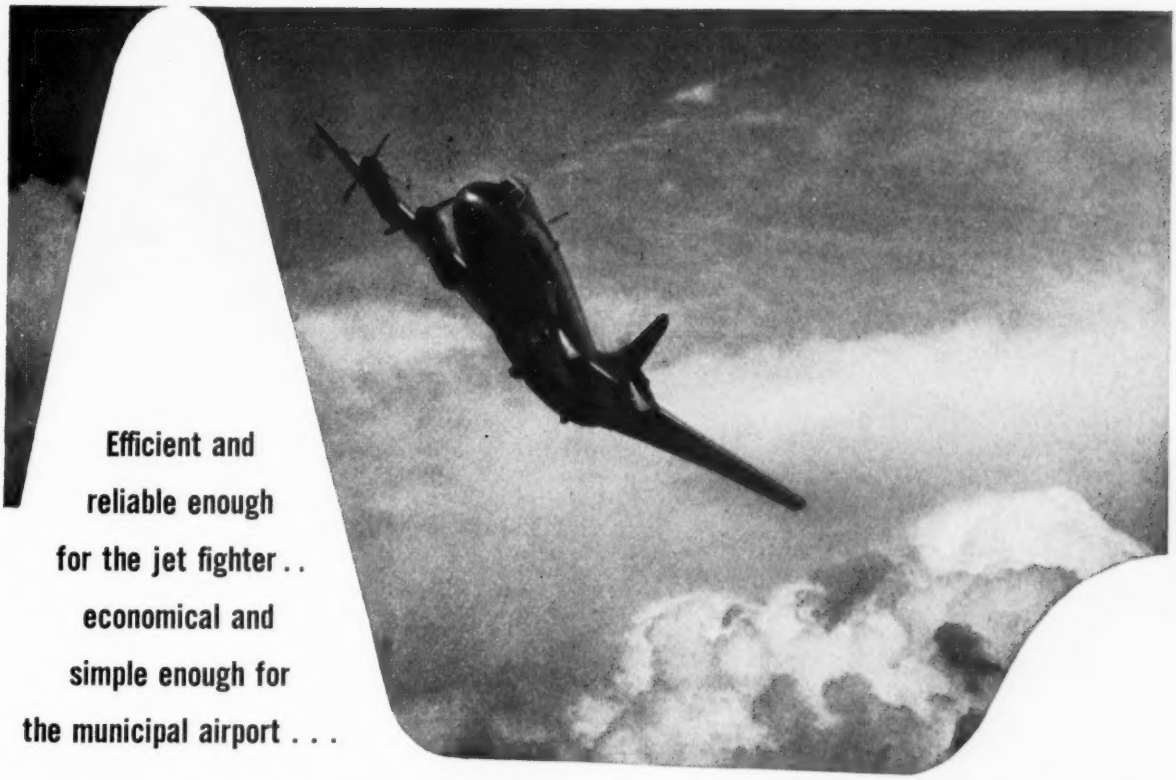
Also, as far as the stators are concerned, there is nothing to stop these being shrouded, with virtual reduction of the clearance to zero. It is even conceivable that the rotors can be shrouded, although this is possibly a much more difficult matter.

Let us now consider the statement that the clearance has to be restricted to 1 per cent of the blade height in order to maintain efficiency. Admittedly, the clearance has to be low to maintain the best efficiency, but the efficiency does not drop off very sharply until the clearance has been increased to a greater percentage than 1 per cent. I would say that a very good efficiency can be obtained with a clearance of, say, 1½ per cent., and that even at 2 per cent. the fall in efficiency can be easily tolerated when the axial is in competition with a centrifugal compressor at the present state of development. It must be remembered, also that with a given dimensional clearance throughout the compressor the percentage clearance at the low-pressure end will be much smaller than at the high-pressure end, and that overall efficiency will not drop to the same extent as the efficiency of the last stage. Taking 2 per cent. as our radial clearance in the back stage, it follows (since area with similar machines is proportional to the linear dimensions) that the flow of 60 lb/sec can, on this score alone, be cut at least four times, to 15 lb/sec, before any substantial drop in efficiency occurs.

In fact, I would say that an axial compressor of 10 lb/sec flow can easily be designed and can be expected to run with an efficiency not far below the best; and if some designer were to produce a high-efficiency compressor with mass flows even lower than this value I would not be unduly surprised.

Mr. Stephenson's conclusions must obviously be in error when one considers compressors already in existence with flows extending down, in some cases, to less than 20 lb/sec. One can quote the Armstrong Siddeley Mamba, the Ruston and Hornsby 750 kW set and the B.T.H. *Auris* set, to name but a few, all of which have good compressor efficiencies.

Lest it be thought that I am purely an axial-flow-compressor proponent, I would like to remark that for my sins I have to design such compressors from time to time, but I also have to design centrifugals. Without wishing to revive the old, bitter and well worn controversy in which the advantages and disadvantages of both types have been presented many times, I would like to say that I have an affectionate regard for the centrifugal and consider that it certainly still has its place in the scheme of things. I would add that it would have an even bigger place if anything like the amount of intelligent research and development had been given to it that the axial has had. However, in these notes I have tried to confine my remarks to things as they are with the axial, and not as they might have been, and will probably yet be with the centrifugal. Both types of compressor have their correct spheres. It would be folly of the greatest magnitude to belittle either.



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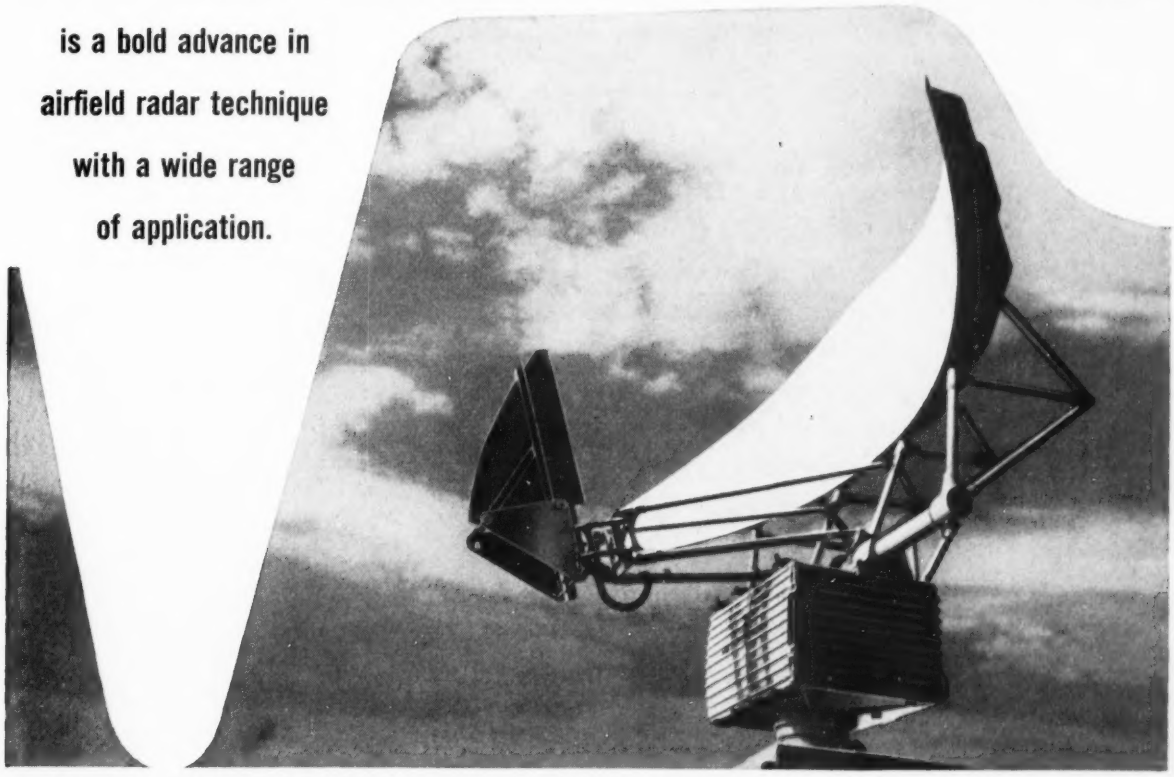

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DON'T IMAGINE (said the Managing Director) that I *like* the game. Far rather would I be among my happy employees, laughingly finding fault with their work and jollying them on to greater efforts for the honour of the Dear Old Firm. Only a stern sense of duty and the need to let a Very Important Customer beat me at something, gets me on to the golf course on this glorious autumn day. The Customer First! That is the spirit of Desoutters.

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FICTION and FACT

A PRESSURE suit developed for the U.S. Navy, and successfully tested in a pressure chamber to a simulated height of 70,000ft, seems to be the nearest thing yet to the interplanetary space-suits of the science-fiction magazines. This characteristic, and the existence of the suit we describe, were mentioned in an article on high-altitude clothing in *Flight* of October 9th.

The full-pressure suit, as it is now generally known, has been designed to protect the future crews of new types of aircraft now under development for the Navy, who may have to abandon their craft at heights of 100,000ft or more. Made of rubber, and with a spherical Plexiglas-fronted helmet, the suit inflates automatically in the case of aircraft-pressurization trouble; and it carries its own oxygen and pressure systems to sustain life as its wearer falls to breathable atmosphere. The need for such a suit has long been recognised, for loss of cabin pressure at altitudes above 50,000ft can result in death in seconds. Most previous attempts to develop such suits have not been entirely satisfactory, because the equipment has proved too bulky and cumbersome or has afforded only limited protection. A major problem of design, also, is the fact that the inflated suit tends to become rigid, like a tyre, thus spreadeagling the unfortunate wearer.

The Navy suit is the culmination of many years of development by the B. F. Goodrich Co., Akron, Ohio. Interest in the problem was first roused as long ago as in 1934, when the pioneer, Wiley Post, approached the company to see if they could design such a suit to protect him during an attempt on the altitude record. At the request of the Air Force, development work on pressure suits was renewed in 1941, when the pressurization of Boeing B-17s was not working out as planned. Production and testing of suits continued throughout the war, but none was used operationally, since aircraft seldom went above 35,000ft.

In 1949, by reason of the high altitudes attained by American rocket and jet research aircraft, the need for an efficient and reliable pressure-suit became urgent. The Navy placed a contract for Goodrich to improve and adapt the principles developed on earlier suits; work began that year and culminated in the suit illustrated on this page.

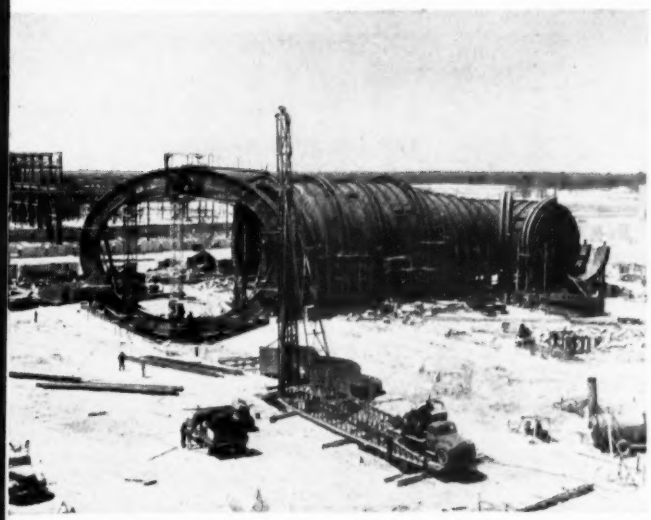
The main advantages claimed for the suit are its flexibility (which offers the wearer a much higher degree of mobility than that given by its predecessors) and the complete, self-contained protection which it provides. It is claimed that, no matter what happens at any altitude to the aircraft pressure system—even at 100,000ft, or higher—the pilot will be able to complete his mission. In the event of his oxygen supply being damaged, he has enough pressure and oxygen in the suit to enable him to get down to lower altitudes, where the atmospheric pressure is high enough for him to survive. In the case of such an emergency, the suit takes over automatically, pressurizing itself and furnishing oxygen without any action on the part of the pilot.

Development of the suit at B. F. Goodrich was a team affair. The company's experience in pioneering items such as pressure-sealing zippers, canopy seals, surge boots and immersion suits proved invaluable in the general development, but much of the individual credit for the solving of the varied problems involved may be given to Carroll Krupps, who has worked on the suit since 1941 and has recently been appointed manager of the company's new products development department.

The shape of things to come: the Wellsian figure poised on an ejector seat is wearing the new full-pressure suit designed by Goodrich for the U.S. Navy. The suit offers greater mobility and better visibility than has so far been offered by fully pressurized suits.

The suit is now undergoing further rigid testing at the Aero Medical Laboratory of the Naval Air Materiel Center, Philadelphia. Future possibilities are seen by the Navy scientists working on the project. One is that it may be possible to substitute the light-weight suit for the relatively complex systems now used to pressurize the whole cockpit on some types of military aircraft. The saving in weight could result in a useful increase in height, speed, or range. M.F.A.

WIND-TUNNEL MOTORS OF 83,000 h.p. EACH



BELIEVED to be the largest and most powerful ever built, two electric motors rated at 83,000 h.p. each have been installed in a series of transonic and supersonic wind tunnels now under construction at the Arnold Engineering Development Center at Tullahoma, Tenn., one of the nine research establishments of the U.S.A.F. Air Research and Development Command.

With two other motors of 25,000 h.p. each, these units will provide a total of 216,000 h.p. to drive five compressors. For the major supersonic tunnel, rumoured to be capable of generating wind speeds of up to 2,500 m.p.h., four of the compressors will be coupled together. The main power assembly of motors and compressors constitutes an axial machine over 500ft in length. Each of the big motors has an armature shaft 31ft 8in long which runs at 600 r.p.m.

The forged blades of the compressor, six feet in length and two feet across the widest part of the face, are said to weigh some 13 cwt each.

As may be imagined, installation of equipment of this size was a major engineering operation in itself. A powerful overhead crane was built into the roof of the motor room and used to lift the 120-ton armature (how it was transported is not stated) and position it in the stator casing. Westinghouse Electric Corporation built the motors at its East Pittsburgh plant.

The transonic tunnel under construction at Tullahoma; its closed circuit will be 1,126ft in length, maximum outside diameter 55ft and working section 16ft by 16ft by 40ft long. The supersonic tunnel is 1,600ft long.

CIVIL AVIATION . . .

AIR, LAND, SEA

—inter-related Problems: The Chairman of London Transport Answers Some Topical Questions

Mr. John Elliot, chairman of the London Transport Executive. His personal views on some topical transport problems are quoted below.

THE ever-increasing growth of air traffic has emphasized the relationships between air and surface transport. Many problems are common to both and can best be solved by a joint approach; a case in point is the difficulty of speeding up communications between city centres and airports. We recently discussed this and other problems with Mr. John Elliot, 1953-54 President of the Institute of Transport.

Mr. Elliot's career in transport began in 1925 when he joined the former Southern Railway, of which, in 1947, he was general manager. He was in charge of the London Midland Region of British Railways—the biggest—in 1950, and chairman of the Railway Executive from 1951 until his recent appointment as chairman of London Transport. Although most of his professional life has been devoted to railways he has a keen appreciation of the value of air transport, and has flown to Australia and in the United States. He is a former director of Railway Air Services and its subsidiaries, Channel Islands Airways, and Olley Air Services; and in 1945 he was appointed a member of the temporary board formed by the Caretaker Government to launch B.E.A.

Mr. Elliot emphasizes that the views which he has expressed in reply to our questions are his own, and must not be taken necessarily to represent official policy of any kind.

Last year London Airport handled 845,000 passengers and it may handle over three million in 1955. What appears to be the best way of carrying this extra city-to-airport traffic on an already congested route?

By rail, if it is practicable.

Tube, or main line?

There are various possibilities. It has been suggested that the existing Piccadilly Line might be extended from Hounslow West to the airport. It would, however, be impossible to run both non-stop express trains for airline passengers and the normal stopping services (which carry far more people than are ever likely to use the airport) over the existing Piccadilly tracks as they stand today. The whole problem is now under consideration by the various authorities. A spur line from the Southern Region Windsor Line is another of the possible solutions to be examined, as is a similar one to the north from the Western Region main line from Paddington. If it proves practicable the time taken by electric or diesel trains to carry passengers between the airport and the London rail termini should be about 35 minutes. A full engineering survey would have to be made before the cost of such a spur line and any other works involved could be assessed, but it would certainly be a large figure. When this has been done the commercial and operating prospects of a rail service will have to be worked out. All the railways mentioned are already used to capacity at peak periods.

Gatwick has been provisionally chosen as London's No. 2 airport. At present one can reach Gatwick Airport by train from Victoria in about 40 minutes. Will this existing rail link be capable of meeting the airlines' future requirements?

With some improvements—additional signalling, provision of lay-bys, and so on—the foreseeable traffic could be handled satisfactorily. There should be no increase in the time taken to reach Gatwick.

Customs clearance on sealed trains connecting airports and cities has been suggested as a useful way of reducing delays experienced by air travellers. Has this plan been considered by the railways?

Yes—ever since I can remember; but this is essentially a matter to be decided by the Customs and Excise authorities. It can be done only if Parliament were to agree to a more cursory examination of passengers, for Customs procedures are of course precisely governed by import and export regulations.

Are internal services yet regarded as serious competition by the railways?

From my previous knowledge, I would say that competition is not yet serious (although it is growing), but that it is regarded seriously.

Channel air ferries already appear to have taken away a good deal of traffic from the surface ferries run by British Railways. Do you foresee further increases in this area of competition or, alternatively, any merging of interests?

Here again, I can express only my personal views. If Air Commodore Powell had started his air ferry in pre-war days, the Southern Railway might well have thought it good business to invest in it. The railways before the war had roughly a 49 per cent holding in some of the larger bus companies without attempting to run the buses for them. The same policy could be applied with airlines. Many of your readers will recall the formation, as far back as 1933, of Railway Air Services (of which I was a director). There is a lot to be said for a selling organization which can channel the traffic into road, rail or air as the passenger may wish. Basically, all forms of transport are offering the same product to the passengers, but in varying quality (*e.g.*, speed). If the passenger wants to go out by sea or rail and come back by air on the same ticket, it can be made easy for him to do so. There can still be healthy competition of service between two transport companies with some kind of financial partnership, and between State-owned transport corporations, without sacrificing co-ordination.

Are you convinced by those airline authorities who regard the helicopter as the answer to economic short-haul air transport?

On present evidence, no. For example, I cannot yet foresee helicopters carrying any significant portion of traffic in the Greater London area.

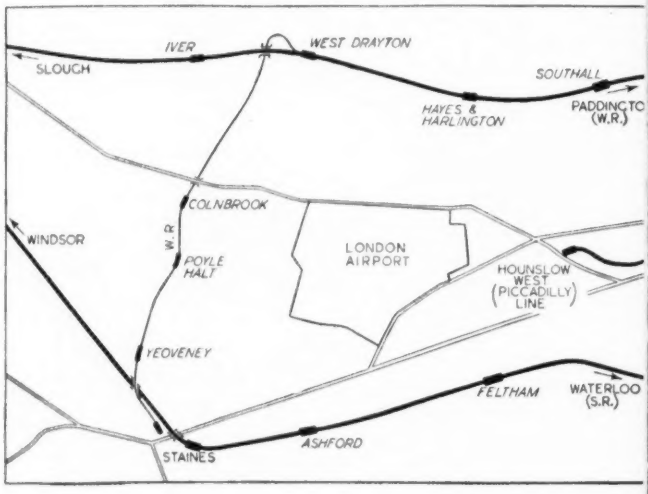
Are helicopter platforms over railway termini acceptable from the railway point of view?

Yes, in principle. But the possibility of an emergency descent on the concentration of tracks just outside would have to be taken seriously into account. At Waterloo, for example, the alighting platform might have to be a good deal larger than would normally be needed for helicopters, in order to protect the busy rail approaches to the station.

Surface-transport operators sometimes protest against the extent of subsidies paid to competitors in the airline business. What are your feelings on the matter?

This is not really a fair question. As a transport man, I am against subsidies on principle. Low fares are justified only when they result in receipts covering costs and interest on capital to a greater extent than would be the case without them. Otherwise, one kind of passenger is subsidizing another—and maybe where it is least justified. Air transport, however, often involves issues of national policy outside the province of the surface-transport operator.

London Airport and the three potential rail-connections—underground and surface—discussed above are shown in this map. Although the airport is only 14 miles west of the city-centre, the coach journey is scheduled to take 1 hr 25 min.



B.O.A.C. AT THE HALF-YEAR

RESULTS are available for B.O.A.C.'s operations in the first half of the current financial year. In the 28 weeks ended October 10th, the Corporation made a profit of £644,000 (a clear surplus of £123,000 after payment of interest on capital). In a message to the staff, Sir Miles Thomas observes that the surplus figure is actually £23,000 below that for the corresponding period of 1952. Traffic between the United States and this country was below expectations and although the Coronation brought extra eastbound traffic, it caused aircraft flying in the opposite direction to be lightly loaded; load factors dropped below 60 per cent during the few weeks before and after June 2nd. Replacement of Hermes with Argonauts on the East African routes, Sir Miles says, will improve B.O.A.C.'s financial results by about £½m in the second half of the current financial year.

NEWS OF FERRYFIELD

IT is reported that the Kent County Planning Committee have approved Silver City Airways' proposal to build an airport in Romney Marsh and that, subject to certain conditions, the M.T.C.A. is prepared to issue a licence. It is also said that the airport, appropriately to be named Ferryfield, will have two runways—one of 3,300ft and the other of 3,600ft—and that the site chosen, about a mile from Lydd, is in a loop formed by the old railway from Lydd to New Romney.

It is expected that the main cross-Channel ferry route will be from Ferryfield to Le Touquet; the local authorities at Le Touquet have already spent about £400,000 this year in improvements, and further work is planned. Silver City will also open another short route—from Lympne to Calais. The new airport, which is expected to be in commission by midsummer next year, will be fully equipped for night flying. Had night-flying facilities been available at Lympne, it is estimated that more than 50,000 vehicles would have been transported this summer.

As it was, Silver City's Freighters and Superfreighters lifted 38,000 vehicles in the first 10 months of 1953 compared with 10,344 in the corresponding period last year. One vehicle in five crossed by air this year, compared with one in fourteen last year.

FIREWORKS AT GATWICK

AN audience of 500 crowded into the Airwork canteen at Gatwick Airport on November 5th to take part in a public discussion of the Government's plan to develop Gatwick as the main alternative to London Airport. The meeting, described as "spirited and sometimes rowdy," gave the numerous local residents who have opposed the scheme an opportunity to place their objections before Mr. Alan Lennox-Boyd, Minister of Transport and Civil Aviation. Sir Gordon Touche, M.P. (Con., Dorking), presided and Sir Miles Thomas and Mr. Peter Masefield were also present.

As expected, Mr. Lennox-Boyd made it plain that there was no question of the Government's changing its mind about the choice of Gatwick as the proposed alternative. For those who have accepted the plan as inevitable but who object to details of its execution, the most important moment of the meeting was Mr. Lennox-Boyd's announcement that it would be the subject of a public inquiry.

To be conducted by an inspector of the Ministry of Housing and Local Government, by arrangement with the Ministry of Transport and Civil Aviation, the inquiry would hear and report on local objections related to the suitability of the site, or to the effect of the proposed development on local interests.

Replying to the suggestion that the inquiry might not be impartial, Mr. Lennox-Boyd said that whoever was appointed would have the integrity of a High Court Judge and he promised that contracts for work on the extension of the airport would not be placed until after the inquiry. He refuted the claim that the plan would cost £20m and said that the first stage of the development, requiring an additional 300 acres, would be £6m; the second stage (and this included the construction of a northern runway which might not be required at all) would cost another £4m. The saving through the closing of other airports would be £450,000 a year.

The important thing about Gatwick's weather, particularly fog, was that it was different from that at London Airport. To illustrate this contention the Minister quoted the following visibilities at the two airports (Gatwick's figures in parentheses) throughout that day up to 10 minutes before the meeting began: Midnight, 1,000 yards (over 1,200 yards); 4.30 a.m., 300 (over 1,200); 7.30 a.m., 200 (over 1,200); 9.30 a.m., 450 (over 1,200); 11.30 a.m., 400 (2,000); 3 p.m., 700 (1,200); 4 p.m., 800 (1,200); 5.15 p.m., 1,000 (500); 7.30 p.m., 900 (1,000); 7.50 p.m., 750 (1,000).

Mr. Lennox-Boyd also announced British Railways' proposal to close the present Gatwick station and to enlarge the present racecourse station to serve the new terminal. There would be no difficulty in providing adequate train services.

RIVALS on America's first coast-to-coast non-stop air services are the DC-7, operated by American Airlines, and T.W.A.'s Super Constellation (below). Both airlines operate first-class services on the same 2,470-mile route—between Los Angeles and New York.

BREVITIES

FOR the second year in succession, A. Cdre. Griffith Powell, C.B.E., managing director of Silver City Airways, has been appointed chairman of the British Independent Air Transport Association.

* * *

A sudden gale which struck Houston Airport, Texas, on October 26th, destroyed or damaged a large number of passenger-carrying aircraft owned by airlines or business corporations. The casualties included a Braniff DC-6, seven DC-3s, five Lodestars and five Beechcraft twins.

* * *

The improvement in B.E.A.'s summer traffic is well shown by the fact that during the 12-month period ended September 30th 1,596,000 passengers were carried, compared with 1,400,000 in the year ended March 31st.

* * *

An extension of VHF coverage in Jugoslavia will result from a new agreement between the Jugoslav civil aviation authorities and International Aeradio, Ltd., whereby the company will provide further radio stations for use at Belgrade, Zagreb and Skoplje.

* * *

Speaking in the Dail on November 4th, Mr. Sean Lemass, Minister for Industry and Commerce, said that the total loss incurred by Shannon Airport since its establishment 13 years ago was £1¼m. The loss for the year ended March 1953 was about £130,000.

* * *

K.L.M. are co-operating with Pakistan in the planning of Super Constellation services between Karachi and London, to be opened next April by the projected Pakistan State airline. The Dutch company will provide Pakistan with personnel-training and overhaul facilities at Schiphol.

* * *

A B.E.A. Viscount, operating a normal scheduled service from London to Renfrew on November 6th, made the fastest time yet recorded on this route by an airliner. Flown by Capt. W. J. Johnson, it covered the 344 miles in 1 hr 12 min, which represents a block speed of 287 m.p.h.

CIVIL AVIATION . . .

Air France claim a new unofficial record for the 832-mile journey from Le Bourget to Algiers. Carrying 42 passengers, a Comet covered the distance in 1 hr 46 min on November 3rd—an average speed of 471 m.p.h. The company's normal Constellation services on this route are scheduled to take 2 hr 25 min.

* * *

The procedure for checking the assembly and operation of Rumbold safety belts (types M.192 and M.368) for possible defects is set out in *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft No.* 41, *Issue* 2.

* * *

Air transport movements at United Kingdom aerodromes in September totalled 23,800, some 9 per cent more than in September 1952. The number of passenger movements was 443,000, an increase of 22 per cent, and—due mainly to Silver City's increased ferry traffic—the amount of freight on- and off-loaded went up by 77 per cent to 8,300 short tons. Combined passenger movements at London and Northolt Airports during the month increased by 17 per cent to 235,000. On average, there were about 155 take-offs or landings per day at London Airport, the total for the month being 4,700, 33 per cent more movements than in September 1952.

* * *

Fines and two-month prison sentences (the latter were suspended) were imposed on three Germans last week at Stuttgart for violating Allied regulations by purchasing powered aircraft in Switzerland. The defendants—a business man and two former Luftwaffe pilots—were the directors of a company licensed to operate from Stuttgart and Munich with chartered aircraft.

* * *

A U.S.A.F. trooping and cargo contract valued at almost £900,000 has been awarded to Seaboard and Western Airlines. The contract will more than double Seaboard's present operations on two routes between the United States and Japan—from California to Tokyo *via* Honolulu and Wake Island, and from Washington to Tokyo *via* Anchorage, Alaska and Shemya.

* * *

The following appointments are announced by B.O.A.C.: Mr. R. H. Trench Thompson, at present B.O.A.C. manager, Pakistan, to be manager, North America, in succession to Mr. J. Ross Stainton, who becomes general sales manager at the head office in London; Mr. Winston Bray, formerly general sales manager, to be sales planning manager; Mr. J. Linstead, manager, Far East, returns from Hongkong to assist the sales director.

FROM THE CLUBS

ONCE having obtained the flying training and experience required for the Private Pilot's Licence, most pupils do not normally meet with much difficulty in the written examinations in aviation law, navigation and meteorology. There has been a need for some time, however, for a comprehensive guide to these subjects for, in the past, although there was no lack of published information, reference to several sources was normally necessary to obtain the whole picture.

This need is well satisfied in a recently published handbook*, written by H. H. ("Eddie") Edwards of the Fair Oaks Club. In it the author first outlines concisely the overall requirements for the Student's licence and the P.P.L., and then deals in turn with the basic facts of air law, navigation and meteorology. The general presentation is good, and the illustrations are clear; altogether a most useful 100 pages for the guidance of any student pilot.

HIGH AND HANDSOME: On the Fellaria glacier of the Piz Palü mountain, Switzerland, trial landings in connection with the Swiss Alpine Club's rescue operations were recently made by Fredy Wissel, a St. Moritz hotel-owner and private pilot. The aircraft is his Piper Super-Cub; height above sea level, some 12,000ft.

GROUND training of student pilots, also, is the idea behind this winter's series of Wednesday-evening sessions just begun at the Elstree Flying Club. The opening talk dealt with licence requirements and theory of flight, and the remaining subjects will include airmanship, navigation, meteorology and engine handling. On the social calendar, a "tramps' party"—with fireworks—was held on November 7th. Almost three months ahead of schedule, the club's target of 2,000 flying hours for the year was reached on October 4th.

FROM Moscow comes news of a flight made by Pyotr Zakhudalin, a member of the Chkalov Aero Club, on October 31st. Flying a Yak-11 trainer, he covered a 2,000-km closed circuit at an average speed of 360 km/hr (225 m.p.h.). According to Moscow radio, "This is the first time in world air sport that this average speed has been achieved on this type of plane. Details pertaining to the flight have been sent to the Central Aero Club for registration as a Soviet record, exceeding the world record."

We understand that there is in fact no world record for this size of machine (class C.1.d.) over this distance, although records for 500 km and 1,000 km closed circuits (471 km/hr and 442 km/hr respectively) by Yak-11 machines have been confirmed by the Fédération Aéronautique Internationale.

THE annual dinner of the Association of British Aero Clubs and Centres will be held on November 20th (7.30 for 8 p.m.) at the Waldorf Hotel, London. Lord Runciman, President of the Association, will be in the chair, and the speakers will include Mr. Alan Lennox-Boyd, M.P., Minister of Transport and Civil Aviation, and Mr. George Ward, M.P., Under-Secretary of State for Air. Tickets for the dinner, price 25s, may be obtained by those interested in the flying-club movement through any A.B.A.C. club, or from the Association's office at 7c, Lower Belgrave Street, London, S.W.1. (Sloane 1864). The Association regrets that no arrangements can be made for ladies to attend the dinner.

R.Ae.C. PILOT'S CERTIFICATES ISSUED—OCTOBER

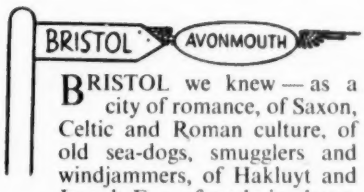
No.	Name	Cl	Date	No.	Name	Cl	Date
28,528	L. Gould	3	1.10	28,537	B. A. H. Hitchings	1	20.10
28,529	D. C. Gifford	4	6.10	28,538	S. J. Tweedie	2	20.10
28,530	G. L. Verran	1	7.10	28,539	R. Leech	1	21.10
28,531	M. J. Baird-Smith	1	7.10	28,540	A. S. Everett	2	21.10
28,532	S. R. Whitehead	3	9.10	28,541	E. P. Heath	4	26.10
28,533	G. E. W. Evans	4	9.10	28,542	J. P. Deal	2	26.10
28,534	B. P. Carroll	3	16.10	28,543	R. M. Begbie	1	29.10
28,535	B. H. Dowson	2	16.10	28,544	J. A. B. Ogilvie	4	29.10
28,536	J. Ward	4	19.10				

* *Student and Private Pilots' Handbook, by H. H. Edwards. Published by Pitman. Price* 12*s* 6*d.*

Landscapes in Oils. 7.

All Avonmouth and Bristol Fashion

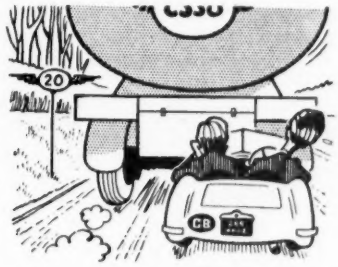
BY BERNARD HOLLOWOOD



BRISTOL we knew — as a city of romance, of Saxon, Celtic and Roman culture, of old sea-dogs, smugglers and windjammers, of Hakluyt and Joseph Fry, of trade in slaves, tobacco, cocoa, wine, sugar, bananas, grain and oil, of modern aircraft factories, pretty girls and ancient pubs echoing with the dot-and-carry perambulation of wooden-legged mariners — but Avonmouth had somehow managed to avoid us.

" You can't miss it," our advisers told us. " Aim for Bristol, for the tall masts of ocean-going ships rising against the walls of the cathedral, and when you get there follow any ESSO tank truck proceeding in a westerly direction."

We carried out the instructions, fell in behind an outsize red reservoir on wheels and coasted in leisurely fashion at exactly twenty miles an hour under the Clifton Suspension Bridge and along the broad highway flanking the Avon's gorge.



"... exactly twenty miles an hour..."

Half an hour later the tank truck and its escort entered the Avonmouth dockyard; we rounded the granaries and the big ocean dock and pulled up between the Oil Basin and Esso's Avonmouth Ocean Terminal. The truck was driven into the depot for its routine check-up and to receive another load of 3,600 gallons of aircraft fuel, and the driver slipped into the canteen for a cuppa. We were still on his tail.

" No," he told us, " the big chaps aren't really difficult to 'andle, not once you know their length. Wheel's nice an' easy, much easier'n they double-decker buses. Ah, that's roight."

His truck, which he nurses like a baby (" Ah, she done more'n eight thousand moiles on one set of tyres ") is one of the Terminal's fleet of forty, and each truck makes on the average two deliveries a day. Where to? " Well, to South Wales, an' up to Birmingham, to the Cotswolds and the Mendips. Ah, there was one toime we got stuck in the Mendips. Snow and roads like glass. But luckily it were the day when the garbage collectors called in this 'ere village and all the people had put their dust-bins out in the road. So we emptied 'em to make a track over the snow. Old truck shivered once or twice — you know! — and then away she went. Lucky, ah!"

The road tanker fleet delivers about 800 tons of fuel every day, and the 450 ESSO rail tank cars based on Avonmouth about 1,000 tons. So large is the daily " throughput " that storage in the gleaming, aluminium-painted tanks (like rows of neat castles in white sand) seldom lasts more than a few weeks. The fuel is shipped to Avonmouth from the refinery: it is tested aboard the tanker, again in the storage tank and again,

"... tested repeatedly..."

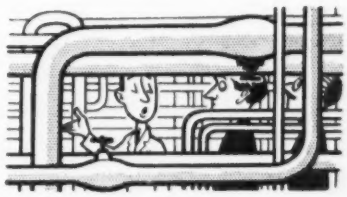
repeatedly, by the hypercritical pundits of the laboratories.

" It's all done by care and kindness," I was told. " All our products are treated on a system of complete segregation."

" You mean . . . ?" I said, and as a large " No Smoking " notice caught my eye I stuffed my half-filled pipe back into my pocket.

" That every product, every fuel, is handled by its own separate pipe-line. There can be no confusion, no mix-up."

" Let us suppose," I said, " that you are delivering a road tank-truck of jet fuel or something to a 'drome at Blandford, Andover, Middle Wallop, Fairford or Little Rissington



"... no confusion, no mix-up..."

—how long does it take you to discharge a load of, say, 3,600 gallons?"

" About half an hour. That's by the modern electric pump method. Under the old system, siphoning it would take anything up to two hours. Mind you, when we're deliverin' motor fuel we often have several calls to make. One thousand gallons here, five hundred there and so on. We try to discharge from the front end first, to ease the steering and put more weight on the driving-wheels and. . ."

" Front end?"

" That's roight. The tank's divided into compartments, separated by bulkheads, so we draw off the petrol from the front end first."

It was getting much too technical for my liking . . .

I wanted to try my hand at the wheel of a 3,600 gallon truck, but they thought very little of the idea. Instead we fell in behind another handsome red reservoir on wheels and proceeded east (as far as Bristol) at a speed of exactly twenty miles an hour.

It pays to say

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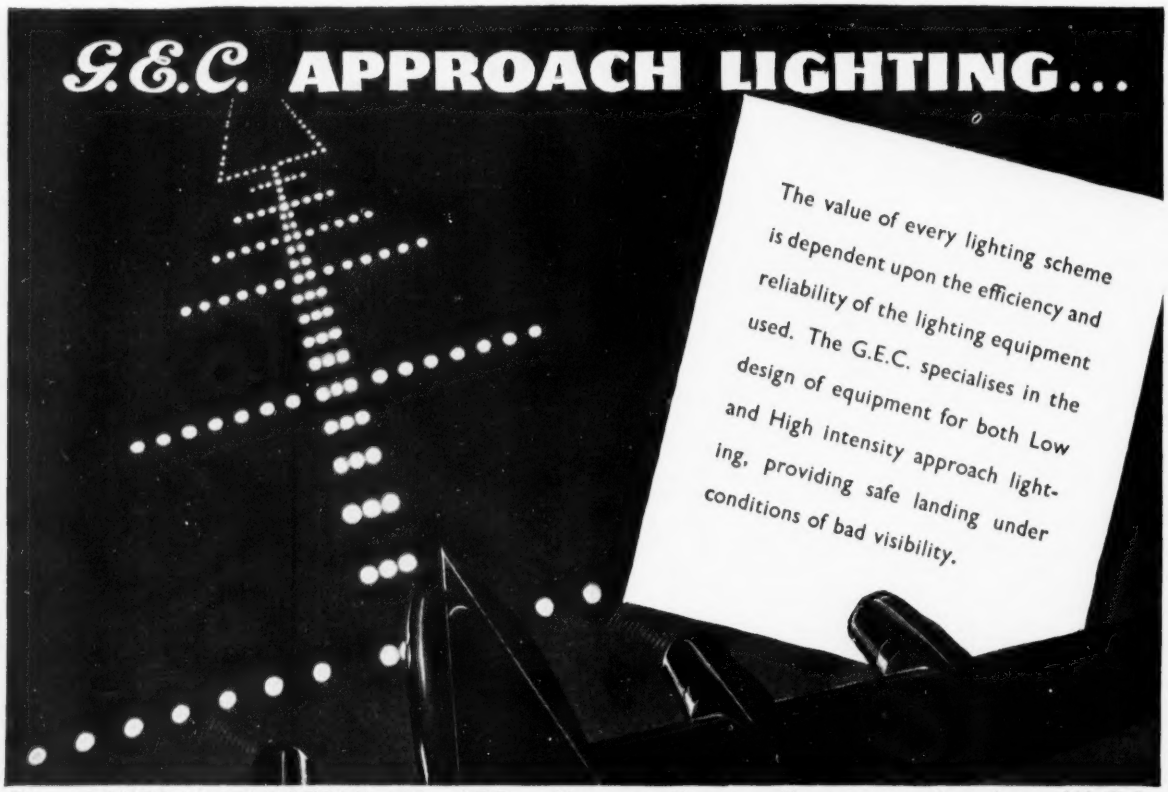
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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

A.V-M. R. L. R. Atcherley

THE Air Ministry announces the appointment of A.V-M. R. L. R. Atcherley, C.B., C.B.E., A.F.C., as Head of the Air Force Staff, British Joint Services Mission in Washington. He will take up his appointment in the New Year.

A.V-M. Atcherley has been A.O.C., No. 12 Group, Fighter Command, since May 1951, and was C-in-C., Royal Pakistan Air Force from February 1949, until that date. Educated at Oundle and the R.A.F. College, Cranwell, he was commissioned in 1924. In 1929 he was a member of the Schneider Trophy team and also won the King's Cup Air Race. At the beginning of the war he commanded No. 219 (Night Fighter) Squadron, and then became garrison commander of the fighter force based in Narvik, Norway, during the German invasion. In 1943 he became A.O.C. No. 211 Group, Desert Air Force. He formed the Central Fighter Establishment at West Raynham, Norfolk, in 1944, and commanded it until September 1945, when he became Commandant of the R.A.F. College, Cranwell.

A.O.C. No. 21 Group

DURING this month, A.V-M. E. N. Nicholetts, C.B., A.F.C., will take command of No. 21 Group, Flying Training Command. He will relinquish the position as S.A.S.O., Coastal Command, which he has held since May 1951. A.V-M. Nicholetts was educated at the Royal Naval Colleges at Osborne and Dartmouth and the Royal Air Force College, Cranwell, and was commissioned in the R.A.F. in 1922. In February 1933, as a Flight Lieutenant, he and the late S/L. O. R. Gayford flew in the specially built Fairey long-range monoplane, from Cranwell to Walvis Bay, South West Africa (5,341 miles) in 57 hr 25 min, establishing a new world long-distance record. At the outbreak of war, he was in the Directorate of Organization at Air Ministry and then took command of No. 228 Squadron, with which he went to the Middle East in 1940. He then served with R.A.F. H.Q. Palestine and Transjordan, and as station commander of R.A.F. Haifa, before going to the Far East in 1942, where he was captured by the Japanese. On returning to England he became S.A.S.O. No. 25 Group, and afterwards C.O. of No. 7 S.F.T.S. He commanded the Central Photographic Establishment before becoming Director of Organization at Air Ministry in 1948.

A.P.R.A. Dinner

PRESIDING at the seventh annual dinner of the Air Public Relations Association on Friday last, Lord Willoughby de Broke announced the introduction of a memorial trophy in honour of the late C. P. Robertson, who for many years was head of the Information Division of the Air Ministry. The trophy, which will take the form of an R.A.F. eagle, will be given annually to the person considered to have made the best contribution in presenting the work of the R.A.F. to the public.

The toast of the Air Ministry and the Royal Air Force was proposed by Dr. B. N. Wallis, Chief of Aeronautical Research and Development, Vickers-Armstrongs, Ltd., who took as his main theme the impact of the mechanical age on the human element. He quoted first from Kipling's "McAndrew's Hymn" (McAndrew was a trifle worried about the effect on men when steamships got up to 30 knots) and then from *Flight*'s account of the record runs on the Swift in Libya, where Mike Lithgow at nearly 750 m.p.h. was in trouble with his cooling suit and oxygen mask. Referring to pilotless aircraft, Dr. Wallis said they were back to where the Wright brothers were in 1903 "with a bit of supersonics thrown in. . . . I have been trying to develop a method of using pilotless aircraft, not unnaturally encountering very great difficulty in bringing them safely to earth again."

Lord De L'Isle and Dudley, V.C., who replied for the Air Ministry, paid tribute to Dr. Wallis and, referring to the re-equipment of the R.A.F., went on to say that "the coping was now being laid on the wall which had been building during the past few years." He took great care to emphasize the fact that supersonic aircraft, guided missiles, and all that went with them, were going to make even more demands on the public purse, but push-button warfare, he said, was not just round the corner.

A.V-M. G. R. Beamish, replying for the R.A.F., spoke of serving in the personnel department of the Air Ministry, where he was in an excellent position to judge the outcome of work done by air correspondents and the Information Division. He praised the integrity of war correspondents.

G/O. C. M. McAlery

WE regret to have to record the death of Group Officer C. M. McAlery, who for many years has been a contributor on Service matters to our contemporary, *The Aeroplane*.

"Mrs. Mac," as she was known to her friends, served in the W.R.A.F. during the 1914-18 war and was unfortunate enough to lose her husband in a Service air accident at Hinaidi shortly after the armistice. From 1919 to 1939 she was a member of the staff of *The Aeroplane*, but on the outbreak of war went back into the Service and rose to the rank of Group Officer in the W.A.A.F., serving as a staff officer in Coastal and Maintenance Commands and as Senior Commandant of the W.A.A.F. Depot.

For the past few years she has lived in semi-retirement in Sussex. She was 58.

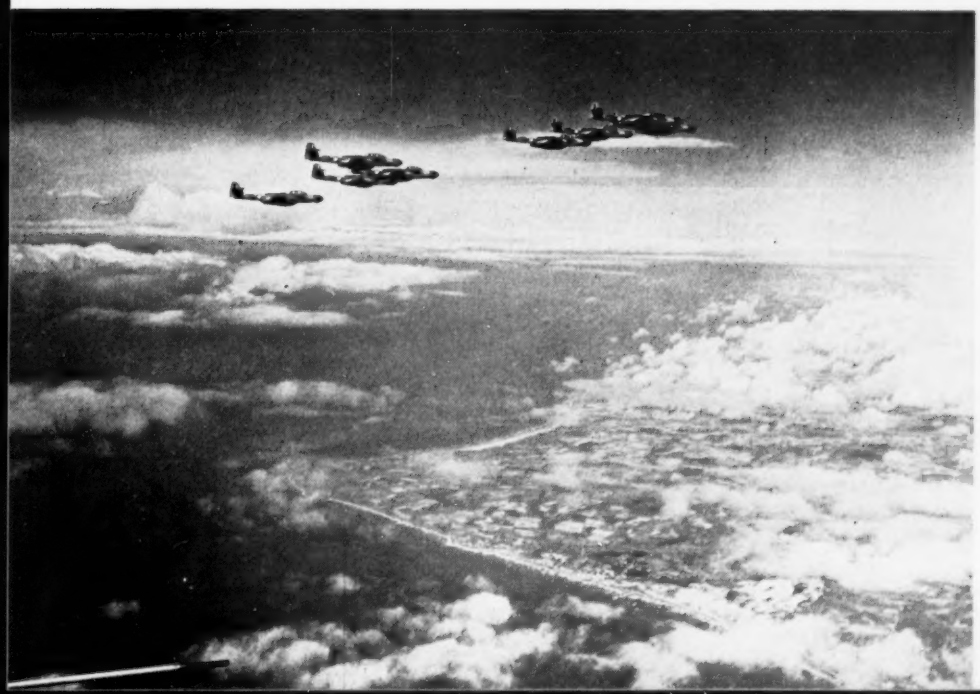
No. 4 Squadron Standard

WHEN No. 4 Squadron receives its Standard on November 20th the presentation will be performed by Marshal of the Royal Air Force Sir John Slessor, who commanded the unit from 1925 to 1928. The present C.O. is S/L. P. W. Gilpin, D.F.C.

The squadron is equipped with Vampires and is based at Jever, near Wilhelmshaven, Germany.

R.A.F. Appointments

AMONG recent R.A.F. appointments are the following: G/C. L. T. Keens, O.B.E., to H.Q. Allied Air Forces Central Europe for staff duties; G/C. J. D. Melvin, to H.Q. M.E.A.F. administrative staff; G/C. H. E. C. Boxer, O.B.E., to department of Chief of the Air Staff; G/C. D. D. Christie, O.B.E., A.F.C., to H.Q. 2nd T.A.F. administrative staff; G/C. R. H. E. Emson, C.B.E., A.F.C., to department of Chief of the Air Staff; G/C. H. B. Collins, to H.Q. No. 206 Group,



ON THE NOSE: Cape Gris Nez lies, breaker-fringed, ahead of the Gloster (Armstrong Whitworth) Meteor N.F.11s of No. 85 Squadron, commanded by S/L. D. Hawkins, D.F.C. The aircraft are carrying their ventral and under-wing tanks.

SERVICE AVIATION . . .

M.E.A.F.; G/C. W. N. Hibbert, to H.Q. Maintenance Command administrative staff; G/C. H. Crowther, to H.Q. Bomber Command administrative staff; G/C. G. M. Gillan to department of Chief of the Air Staff.

Welsh Emblem Omitted

DURING a recent local R.A.F.A. conference at Rhyl attention was drawn to the fact that the new Squadron Standards have no Welsh emblem incorporated in the design. England, Scotland and Ireland are all represented. The Standards are presented by the Queen to units which have completed 25 years' unbroken service, and they can also be awarded for special operational flying by a squadron.

Exercise November Moon

UNDER the direction of Lt-Gen. D. M. Schlatter, commanding Allied Air Forces Southern Europe, a three-day air defence exercise called November Moon was held from November 2nd to 4th. Aircraft of six NATO countries took part in the exercise, which was designed to assess the air defences of the Southern European NATO nations. As well as French, Greek, Italian and Turkish units, U.S. Navy aircraft from the U.S. 6th Fleet, and R.A.F. aircraft of M.E.A.F. and a squadron of Lincolns from the U.K. participated. The exercise showed improvements in organization, especially in communications, over the previous exercise, "New Moon."

Final Parade

SCHEDULED to close down early in 1954, the Rhodesian Air Training Group of the Royal Air Force held its final wings parade last month, at R.A.F. Station Heany, Southern Rhodesia. The reviewing officer was Major General Sir John Kennedy, Governor of Southern Rhodesia.

Following the presentation of wings to the pupils, the badge of the Group, together with the sports trophies, were handed to the Governor by the A.O.C., A. Cdre. G. Bearne. It is intended that the badge will be kept at the Southern Rhodesia Defence Headquarters and the trophies used by the Southern Rhodesian Air Force.

R.A.F. Winter Sports

THIS year the holiday scheme of the R.A.F. Ski and Winter Sports Association will be organized with Ehrwald, Austria, as a base. The association is non-profit making and its aim is to provide the cheapest possible winter sports holidays to all members and ex-members of the three Services, their families and their friends.

During this winter there will be six 14-day holiday periods in the Tyrol, each at an all-in cost per person of £35, including 3rd class rail travel. The first party leaves London on December 22nd and the last on February 24th.

Full particulars may be obtained from the honorary secretary F/L. P. D. O. Coryton, R.A.F. Holiday Scheme Office, 59 St. Mary Axe, London, E.C.3. Telephone Avenue 1803.

Britannia Shield Competition

THE R.A.F., which for the last two years has won the Britannia Shield competition, founded in 1946 to commemorate the Battle of Britain, was this year opposed by teams from Belgium, the Netherlands, Norway, the United States Air Forces in Europe, and the Royal Canadian Air Force in Europe. Contestants arrived in this country last Friday and were officially welcomed at R.A.F. Uxbridge by the Under Secretary of State for Air, Mr. George Ward, M.P.

The four events contested this year were boxing, shooting, swimming and fencing. Canada entered in all the events except boxing, and the other countries in all events. The final events were due to be held on November 10th and 11th.

A perpetual challenge trophy, the Britannia Shield, is presented for competition in a number of sporting events to commemorate the "glorious and unselfish spirit that animated all during the Battle of Britain and the historic assembly on British soil of the Allied Armed Forces fighting for the freedom and independence of their countries." It is made of oak from Guildhall, London, the historic building damaged by enemy action. The original design was produced by Allied airmen and the shield was presented by S/L. E. S. Virpsha, late R.A.F.V.R.

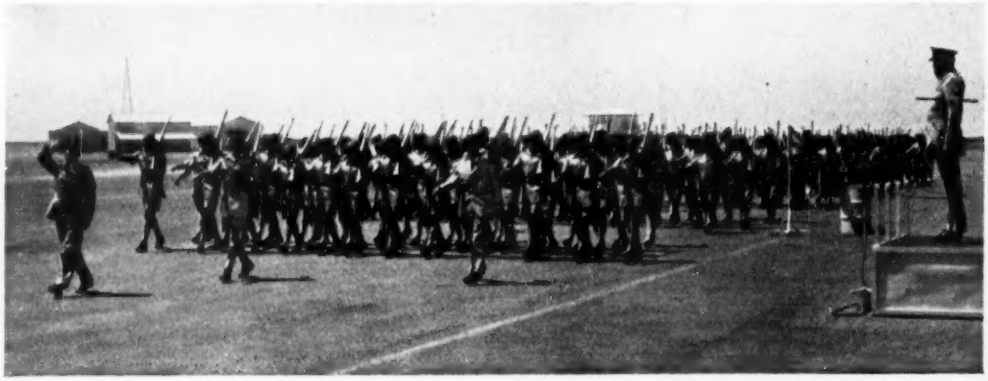
All profits are devoted to R.A.F. charities. After the 1952 competition £1,300 was handed by Air Chief Marshal Sir Arthur Barratt, chairman of the Britannia Shield Committee, to the R.A.F. Benevolent Fund, to be placed to the credit of the Britannia Shield Scholarship Fund for educating sons and daughters of deceased or disabled R.A.F. personnel.

A.T.C. Efficiency Cup

THE winners of the Sir Alan Lees Efficiency Cup for 1953 are No. 1143 (Portobello) Squadron, commanded by F/L. G. Weston.

Reunion

A REUNION of ground and air crew members who served with No. 69 Squadron between May 1944 and May 1945 is to be held at the "Coronet Bar," 10, Soho Street, London, W.1, on November 21st. Details from Mr. J. Swift, 17, Atkinson Street, New Cross, London, S.E.14.



HANDINGOVER: (Above) Major-General Sir John Kennedy admires the badge of the Rhodesian Air Training Group after receiving it from the A.O.C., A.Cdre. G. Bearne. The sports trophies are on the table. (Below) The parade, under the command of S/L. D. T. Fisher, marches past the saluting base. (See "Final Parade" on this page.)

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Gliding—Then and Now

I MUST defend my gliding pupil Ken Owen from the charge of line-shooting brought against him by Mr. Braun (October 30th). In his modest and entertaining article (October 9th) Mr. Owen described how, as a newcomer to gliding, he learned to soar solo in a week. Most readers will not infer that he claimed to have "mastered the art of gliding in a week."

If we no longer take our lives in our hands each time we leave the ground in a sailplane, surely the blame for this lamentable state of affairs is partly due to those pioneers at the Wasserkuppe in the 1920s who discovered the secrets of hill-soaring. Since then, technique has advanced very rapidly. We would do well to remember with gratitude those who made the early discoveries, but few of them would wish gliding to stay as it was then, and most would wish us to use their experience to develop the sport.

Design of sailplanes has also progressed a long way since the days of the Schwarze Teufel and the Vampyr. However, we are still entitled to indulge ourselves in the luxury of designing and building a better aircraft than the Olympia or the Sky (if we are clever and wealthy enough!).

We do not yet fly the T.21 captive on circuits along an aerial ropeway, nor direct Tutors hill-soaring by automatic radio beam. In fact, I can imagine cynical chuckles from fellow-members of the London Gliding Club, and a rather rude word from our resident instructor, when they read of "scientifically pre-determined" flights by beginners!

In the established gliding clubs today the early training is well-organized (and most of us cannot afford to have it otherwise); but when, in due course, the 1950s become the Good Old Days, there will be no lack of flights of adventurous discovery to recall. More pilots than ever before are experiencing the "delights of insecurity" when involved in big cumulo-nimbus clouds or when running out of thermals on a cross-country flight.

Mr. Braun may be especially lucky in the bus-route he patronizes, but many of us, in the 23rd year of gliding at Dunstable, still find such delights more attractive than any bus-ride—even on the top deck!

London Gliding Club, Dunstable. JOHN SIMPSON.

IT was with interest that I read Mr. Braun's letter in your issue of October 30th. With his long-standing and hard-earned experience, he speaks of "mastering the art of gliding within a week." Surely this cannot be true. Mr. Owen's article gave the very different impression of acquiring, over the period of seven days, "a brief first taste of the fascination—and satisfaction—of gliding." Those words are his own, from the closing paragraph of his excellent account: but perhaps Mr. Braun did not read that far.

Furthermore, as a power pilot (albeit of recent standing), I have never experienced the craving for insecurity that appeals to Mr. Braun. On the contrary, I believe the true pleasure in flying derives from a mastery of machine and technique, an understanding which excludes insecurity. Mr. Owen's holiday seems to have been aimed at acquiring this mastery with the minimum of drama and heroics of the sort which could be costly, bring discredit to the gliding movement and leave little scope for further enjoyment of the sport without the encumbrance of a harp.

Oxford. C. L. IONIDES.

WE try to predetermine our training flying these days because we cannot afford the cost of the older methods, both in repairs and in lack of utilization. We don't design and build our own gliders, because they are rather more complicated than those of thirty years ago, and we need our time for flying, which is where the real art lies. Pilot-technique is always more important than the machine, and a one-design contest would really prove who had the best performance—on that day, because everyone comes unstuck at times, and consistency is what really distinguishes champions.

If Mr. Braun wants to find out what changes there are in gliding, he should come to one of the really active clubs and find out—and then keep coming, because we are learning all the time, and the eight types of thermal, and six species of wave, and the three unknown phenomena, on which we can soar now, may have grown by next year. Certainly more people will have learnt blind flying merely by passing on into cu-nims and finding out: and a lot more will have fumbled their way over strange country for the first time; and many more will have gone solo and started to dream at once of their Silver "C." In fact, if he comes along to Dunstable or Camphill or any one of several other places on a good day, we'll give him a ride that will make his Wasserkuppe days seem like pushing a pram round the front lawn.

Stockport, Cheshire. PETER RIVERS.

The First R.A.F. Raid in 1939

I READ with interest Mr. John Yoxall's article (October 23rd) on the past and present activities of No. 9 Sqn., but would beg to correct certain claims made on behalf of that unit in regard to the first R.A.F. raid, and decoration, of World War II.

On the outbreak of war I was serving with 110 Sqn., then equipped with Blenheim Mk IV aircraft. On Friday, September 2nd, 1939, we moved out of Wattisham Airfield and occupied the civil airport at Ipswich. It was from this airfield that aircraft of "110" set out on the first raid of the war. An equal number of the same type of aircraft from No. 117 set out from Wattisham.

In command of the No. 110 aircraft was F/L. Doran. Five were engaged in this raid, of which one (flown by P/O. Green, a Canadian) failed to return. As a result of the operation, F/L. Doran was promoted to squadron leader and awarded the D.F.C. This award was the first to any member of the British Services in World War II.

At a later date (I believe it was October 19th), S/L. Doran was in command of nine aircraft of "110"; they were engaged on an anti-submarine sweep when they were attacked by a flight of Heinkel 110s (it is believed that there were five). As a result of this second brush with the enemy, S/L. Doran was awarded a Bar to his D.F.C. and L.A/C. Greenwood, Wop/AG, was awarded the D.F.M. One aircraft was shot down over the sea; it was flown by Sgt. Hanne, with A/C.1 Vick as Wop/AG. The name of the observer escapes me for the moment.

It will be seen, then, that No. 110 Sqn. had the distinction of winning not only the first award, but the first D.F.C., the first Bar to the D.F.C. and the first D.F.M. On a previous occasion, when I have corrected a similar mistake, the official organ of R.A.F.A. consulted the "London Gazette" and confirmed the information given above.

R.A.F., Wellesbourne Mountford. A. H. FIRTH, Sgt.

Memories of the A. V. Roe Triplane

YOUR "Farnborough" number dated September 18th was most interesting and enlightening to me, a layman, but I was most delighted to see the picture of Sir Alliot Verdon Roe, and to note your comments in reference to his 9 h.p. triplane of 44 years ago.

They brought back to me memories of that long time ago when I was one of a bunch of small kids who, on every possible occasion, impatiently waited outside the hangar situated under the railway arches on the Lea Marshes, ready to give a push or a pull or to act as human brakes during the taxying runs of the awesome contraption of wire, stays, struts and fabric.

We also took over the duty as a running escort to the machine on its earthbound sprints across the marshes, and on one occasion we had the pleasure of preventing it from crashing into the railings which bordered the Lea Bridge Road.

Our reward, and the great thrill, came to us on that memorable summer evening when, after weeks and weeks of abortive effort to rise from the ground, the plane slowly, drunkenly and painfully lifted itself a short distance above the height of the telegraph poles, on its way back to its home "underneath the arches," journeyed unsteadily a short way, and then awkwardly landed.

Thorpe Bay, Essex. HENRY J. CROW.

Lights under Bushels?

IT is a source of continual surprise to me, and no doubt to many other people, that so little space is devoted in *Flight* to news from the flying clubs. Can the clubs be so reticent that their news can only be squeezed out of them under protest? Or can it be that there is no news? I know there are many clubs whose activities never appear in your pages, but they can't be completely static. Others are featured quite regularly, though briefly, and gliding clubs have quite a monopoly.

The vanity of the human race being what it is, seeing one's name in print after having completed that glorious first solo, or obtained a P.P.L., must surely act as a boost to the individual, however he cares to deny it. Mr. Ogilvy's article of September 18th, lamenting the lack of enthusiasm in private flying, is, unfortunately, only too true; but if those people who have an interest in it, could see, week by week in your pages, what other clubs had accomplished, might not they, too, wish to have their progress recorded for all to see?

London, S.W.7. (MISS) M. J. DURHAM.

[Fair comment, and we will see what can be done. But it is a matter of the space available and what most of a world-wide readership wants most of the time.—Ed.]

THE INDUSTRY

Audible Exports

A DAKOTA of the Royal Norwegian Air Force recently collected from this country the first consignment of an order placed with Tannoy Products, Ltd., of London, S.E.27, for airfield control and alarm loudspeaker equipment.

This system enables both verbal messages and a range of electronic warning signals to be transmitted from a central control unit, either to the whole airfield area or to selected points as required. These announcements and signals are broadcast over large areas by single high-power loudspeakers, a recent Tannoy development which, it is claimed, creates an entirely new performance standard in this field. Together with small internal loudspeakers for remote buildings, the speakers are so positioned as to cover fully each important sub-site. Each sub-site installation is powered by a local amplifier and can be selected individually at the central control unit.

The design of this control unit enables telephone cables, often already in existence, to be used for the connection to the sub-sites. It contains a line amplifier, the necessary control switching, a built-in microphone, monitor meter and the electronic warning device. This device gives a choice of seven characteristic and easily distinguishable signals, available at the touch of a button.

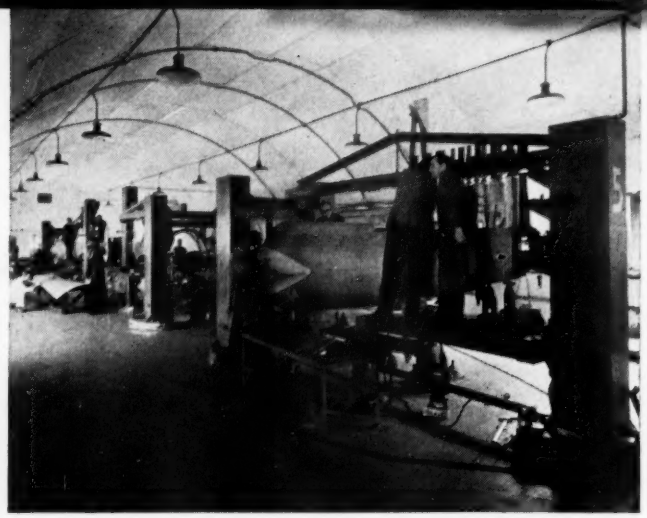
Rack-mounted combinations of 60- and 200-Watt amplifying units are employed to provide adequate reserve for the varying power requirements of each local site.

Tarrant Rushton Activity

UNDERSTANDABLY, mention of the name of Flight Refuelling, Ltd., or of its chairman, Sir Alan Cobham, immediately brings to mind the airborne replenishment systems which the firm has pioneered and developed to such an advanced state of efficiency. Their importance has, perhaps, tended to overshadow the other work of which the company is undertaking a steadily increasing amount at its headquarters at Tarrant Rushton Airfield, Blandford, Dorset.

The scope of this work, as indicated in a new and profusely illustrated brochure, *F-R Services to the Aircraft Industry*, includes research, design and development; airframe component construction; aircraft repair and overhaul; aircraft modification, repair and maintenance of instruments, radio and electrical equipment and safety equipment; mechanical and electrical testing of materials and components; and flight testing. This work is done, under M.o.S., A.I.D. and A.R.B. approval, in shops and hangars totalling a quarter of a million square feet in area.

Photographs in the brochure show Vampire Trainers, Meteors and other aircraft being overhauled in considerable numbers, and on this page we are able to illustrate one aspect of the major-component work now being undertaken.



Hawker Sea Hawk fuselage rear-halves in production in the Tarrant Rushton shops of Flight Refuelling, Ltd. (see accompanying paragraph).

New Aircraft Electrical Cables

TWO new types of aircraft wiring cables have lately been added to the range manufactured by British Insulated Callender's Cables, Ltd. One, known as Nypren, has been designed for use in place of the well-known Pren (a glass-braided, polychloroprene-insulated cable) when there is a possibility of contamination by the ester lubricants now coming into use for gas turbines.

Basically, a Nypren cable has a nylon covering added to Pren, thus affording a useful degree of protection against the synthetic oil. Slight reduction in the thickness of the polychloroprene insulation allows the overall diameter to remain unchanged.

At present these cables are available only in the smaller sizes, which are type-approved to M.o.S. Specification EL 1771, Issue 1.

The other new cable, known as Unifire, is designed for fire-detection and extinguisher circuits and, it is stated, will operate in open flame at 1,000 deg C for at least five minutes. The composite glass and asbestos insulation is impregnated with silicone compounds. Unifire is type-approved to EL 1736.

IN BRIEF

The directors of Rolls-Royce, Ltd., have declared an interim dividend of 5 per cent, less tax, for the year ending December 31st, 1953.

* * *

Amal, Ltd., announce the retirement of Mr. T. W. Clibbery, general manager and a director. Mr. Clibbery, who will remain available in an advisory capacity, has served the company and its predecessor—Amac, Ltd.—for over 40 years.

* * *

Wolf Electric Tools, Ltd., Hanger Lane, London, W.5, are now in production with their new 6in Type GQ6 portable electric grinder. Intended for heavy-duty welding-dressing fettling and comparable duties, the machine runs its resin-bonded wheel at a periheral speed of 8,800ft/min.

* * *

Barlow-Whitney, Ltd., industrial heating engineers, of London and Bletchley, announce the appointment of Mr. H. Melrose, A.M.I.E.E., as district engineer and manager, Midlands area, following the retirement of Mr. J. Hearn Noble. Mr. Melrose will operate from their new offices at 6-8, Holloway Head, Birmingham, 1 (Midland 6897).

* * *

Mr. H. M. Woodhams, managing director of Sir W. G. Armstrong Whitworth Aircraft, Ltd., recently presented 48 clocks to employees who had each completed 25 years' service with the company or with member-firms of the Hawker Siddeley Group. Such presentations have become an annual event and in the last three years 233 clocks have been awarded. All the A.W.A. directors have qualified.

* * *

The United Steel Companies, Ltd., announce that they have established a research fellowship in metallurgy at the University of Sheffield. The object will be to advance metallurgical knowledge and not to give training for research; those appointed, therefore, will be men who have already served their apprenticeship in research and have shown ability to conduct independent investigations.

FORTHCOMING EVENTS

Nov. 17. R.Ae.C.: Film Show, Londonderry House.
Nov. 19. R.Ae.S. Section Lecture: "Aircraft Stability and Control," by A. W. Babister, M.A., A.F.R.Ae.S.
Nov. 20. Institute of Navigation: "Navigation in the U.K.-New Zealand Air Race" by members of the R.A.F. team.
Nov. 20. Association of British Aero Clubs and Centres: Annual dinner.
Nov. 26. R.Ae.S. Graduates' and Students' Section: "The Case for the Light Fighter," by P. A. Norman.
Nov. 28. S.L.A.E.: "Training the R.A.F. Apprentice," by G/C. R. J. Carvell.
Dec. 1. R.Ae.S. Section Lecture: "Integral Construction," by K. L. G. Legg, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S.
Dec. 4. Helicopter Association: "Ground Resonance," by R. Howarth.
Dec. 4. Photogrammetric Society: "Stereoscopic Vision applied to Photogrammetry," by Professor W. D. Wright.
Dec. 9. Royal United Service Institution: "Effects on the Human Body of High-speed and High-altitude Flight," by G/C. W. K. Stewart, C.B.E., A.F.C., B.Sc., M.B., Ch.B.
Dec. 10. R.Ae.S. Main Lecture: "Training Devices for Aircrew," by N. J. G. Hill, A.M.I.A.E., A.R.Ae.S., or deputy (at Belfast).
Dec. 15. R.Ae.S. Section Lecture: "High-speed Wind Tunnels," by D. L. Ellis, B.Sc., A.R.T.C., F.R.Ae.S.
Dec. 17. R.Ae.S. Graduates' and Students' Section: Film Show (jointly with Inst. Pet.).
Dec. 17. Anniversary of the Wright Brothers' First Flight.
Dec. 18-19. Institution of Production Engineers: Conference: "Problems of Aircraft Production" (at Southampton University).

R.Ae.S. Branch Fixtures (to Dec. 18).—Nov. 13, *Chester*, annual dance. Nov. 16, *Halton*, branch night. Nov. 18, *Manchester*, "Developments in Gliding," by A. H. Yates.

Nov. 23, *Halton*, junior members' night. Nov. 24, *Henlow*, films: *Belfast*, "Short Analogue Computor," by E. Lloyd-Thomas: *Boscombe Down*, Inaugural meeting. Nov. 25, *Bristol*, "R.A.F. Operational Requirements," by A. Cdre. W. H. Kyle.

Nov. 27, *Birmingham*, "Uses for the Small Gas Turbine" (speaker to be announced). Nov. 30, *Halton*, films. Dec. 2, *Luton*, "Short-haul and Charter Operations," by a charter operator; *Chester*, "Rocket Propulsion and Interplanetary Flight," by A. V. Cleaver. Dec. 4, *Bristol*, Engineering Association joint dance.

Dec. 7, *Halton* and *Henlow* area meeting, "Design of Fast Load-carrying Aeroplanes," by D. H. Lee, F.R.Ae.S. Dec. 8, *Bristol*, "Fly-past, Present and Future," by Capt. J. Laurence Pritchard, hon. F.R.Ae.S.: *Henlow*, "The Training of Test Pilots," by G/C. S. Wroath, A.F.C. Dec. 9, *Manchester*, "Principles of Weight Control," by F. Howarth, A.F.R.Ae.S. Dec. 11, *Preston*, Wright Brothers' Jubilee dinner dance. Dec. 17, *Bristol*, celebration of 50th anniversary of powered flight. Dec. 18, *Birmingham*, films.

Weston Resistance Bulbs

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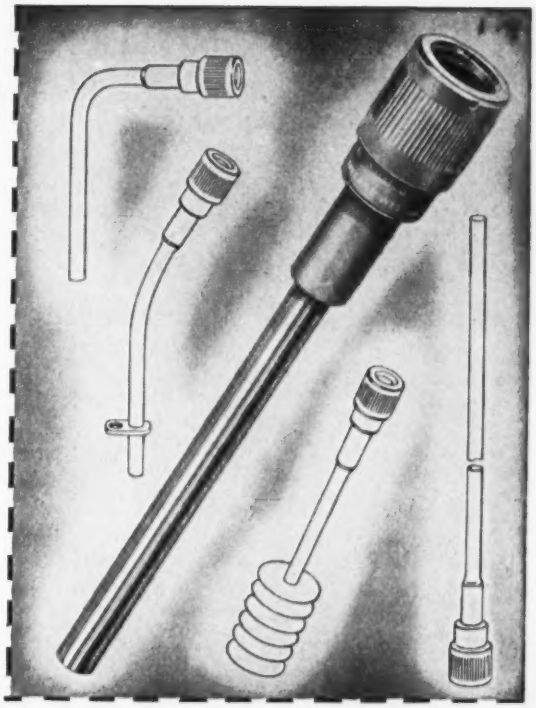

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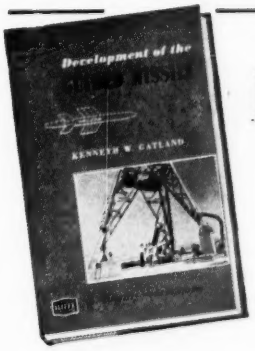

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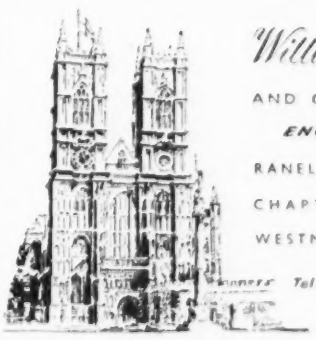

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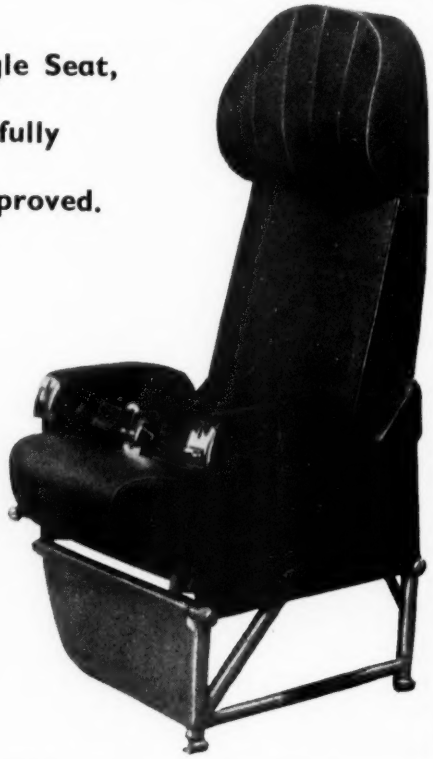

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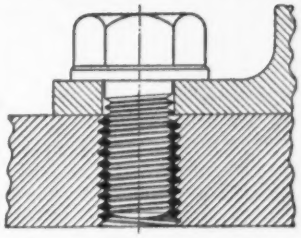

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

From Starways, Ltd., of Speke Airport, Liverpool:

Application No. 221 for a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers between Glasgow (Renfrew) and Tarbes (for Lourdes), at a frequency of from one to three services weekly during the season from June to October inclusive for a period of five years commencing June 1, 1954.

Application No. 222 for a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers between Liverpool (Speke) and Nice (Le Var), at a frequency of from one service fortnightly to two services weekly during the season from June to October inclusive for a period of five years commencing June 1st, 1954.

Application No. 99/1 for approval to operate their inclusive tour service between Liverpool (Speke) and San Sebastian (Application No. 99) which has been approved by the Minister of Transport and Civil Aviation, via the airport at Biarritz instead of the airport at Bilbao for the 1954 season only.

Application No. 98/1 from Transair, Ltd., of Croydon Airport, Surrey, for a variation to the seasonal internal service which they have been approved by the Minister of Transport and Civil Aviation to operate with Dakota aircraft at week-ends only between London (Croydon or Gatwick) and Jersey (Application No. 98), so that the company may cease to operate on Fridays, but increase their frequency on Saturdays only to four return flights, and to increase the season of operation to the period from May 1st to September 30th each year.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections. [1276

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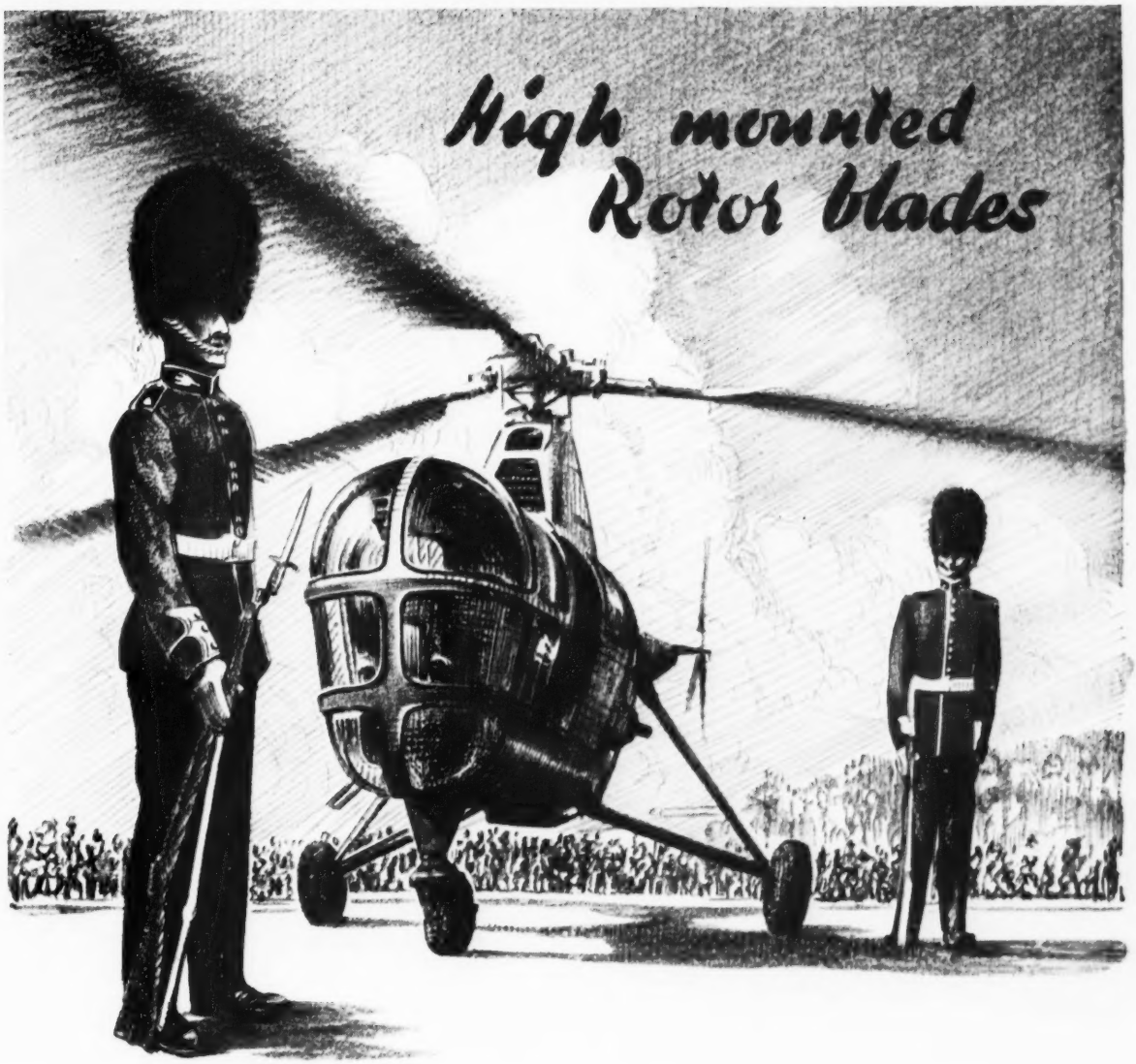

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